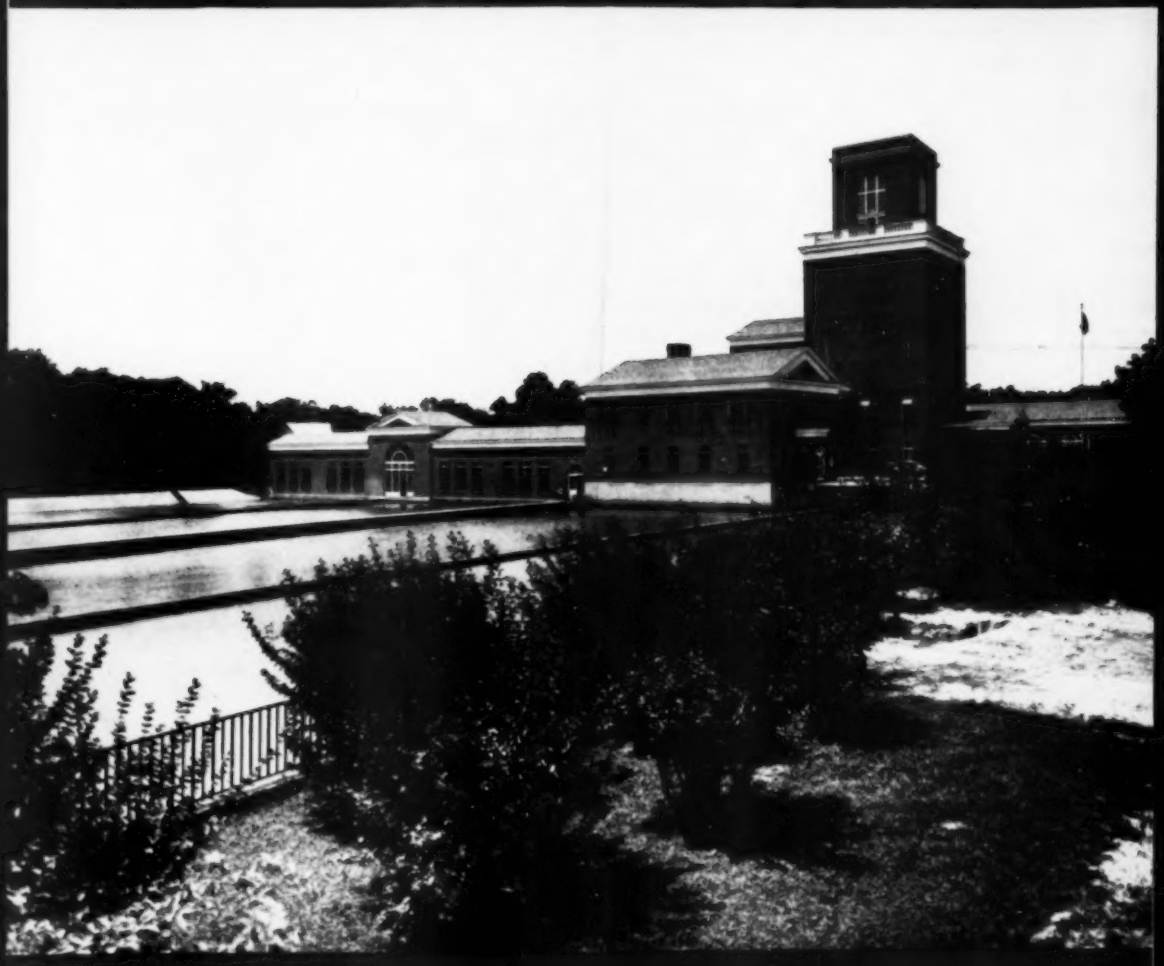
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



NOVEMBER, 1932

Delaware Filtration Plant
Pride of the Nation's Capital Now Boasts
America's Largest Purification Installation

FROM THE CANADIAN BORDER TO THE GULF OF MEXICO... from the Rockies to Lake Michigan, the Ohio and Mississippi Rivers . . . this is the broad sweep of the Great Plains served by Lock Joint's permanent pipe manufacturing plant at Turner, Kansas. Specializing in Lock Joint Prestressed Concrete Cylinder Pipe in diameters from 16" to 48", designed for any pressure common to water works practice, the Turner plant also answers demands for this type of pipe in the Great Lakes area.

. . . LOCK JOINT CONCRETE PRESSURE PIPE is readily available east of the Mississippi from the Company's three other permanent plants in Wharton, N. J.; Detroit, Mich., and Columbia, S. C. Together these four strategically located plants are equipped to handle any contract, however large or small, and offer the ultimate in modern Concrete Pressure Pipe in a variety of standard diameters.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16" in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. • Oklahoma City, Okla. • Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R. • Caracas, Venezuela

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

PIPE LINE CREWS encounter all kinds of conditions from deep woods to the congested streets in the heart of a large city's business district. This cast iron pipe installation could be either a water supply line from a mountain reservoir or a sewer force main leading to a remote treatment plant. If it were a gas transmission line it would, of course, be mechanical joint pipe.

U. S. cast iron pipe in sizes from 2-inch through 24-inch are cast *centrifugally* in metal molds with bell-and-spigot, mechanical joints and plain ends. The *pit cast* process is used in producing all sizes of flexible joint and flange pipe as well as all pipe 30-inch and larger. Highly developed production controls guard the uniformly high quality of U. S. Cast Iron Pipe.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

How they made Philadelphia's 42" force main *Bottle-tight* though it lay 15' below the water table

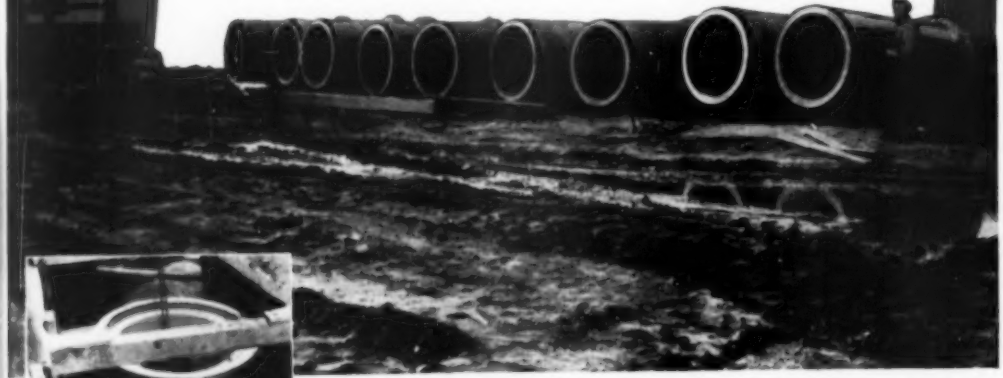
The specifications for Philadelphia's 42" force main sewer were right to the point. "Zero infiltration", they read. What made it worse — the line lay 15' below the water table.

How can you couple 8' long sections of 42" bore concrete pipe and be sure they're *leakproof* — and will stay that way?

Wisely the engineers specified Tylox, the rubber joint that has earned the reputation of being "leakproof for the life of the line."

"Zero infiltration", the specs read. "Zero infiltration" they got. Tested under 15 psi internal hydrostatic pressure, *Philadelphia's force main was bottle tight.*

On that next tough sewer problem, take a tip from Philadelphia, or Oklahoma City, or Covington, Ky., or San Antonio, Texas, specify TYLOX *flexible rubber* JOINTS.



THUMBNAIL FACTS ABOUT PHILADELPHIA'S 42" FORCE MAIN

PIPE: "Vacuum processed" concrete pipe made only by the Concrete Products Company of America or its licensees. 42" bore, 8' lengths.

COUPLINGS: Tylox flexible rubber joints.

ENGINEERS: Bureau of Engineering & Surveys of the City of Philadelphia.

CONTRACTORS: Joseph Lombardi & Son, Philadelphia.

MAKING JOINTS WITH TYLOX RUBBER GASKETS IS AS SIMPLE AS ABC

Cement tongue and snap on Tylox gasket.

Lubricate sliding surfaces with Tylox Cement.

Shove the pipe home.

HAMILTON KENT MANUFACTURING CO.
KENT, OHIO

"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS"

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. Published monthly by Gillette Publishing Co., at **404 North Wesley Ave., Mount Morris, Ill.** Entered as second class matter Mar. 4, 1948, at the post office at Mount Morris, Ill., under Act of Mar. 3, 1879. For subscription rates, See Contents Page.

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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Maintenance Guide for Sewage Wks. Operators ..... *McDonald*
Operation of Small Water Works (One of a Series) ..... *Clark*
Safety Practices in Sewer Maintenance ..... *Van Kleeck*
Equitable Use of Streams by Industry ..... *Phelps*
Small Plant Supt. Reports on Fluoridation ..... *Lesslie*
Solving an Unusual Booster Pumping Problem ..... *Dobbin*
Activated Silica in Water & Ind. Waste Treatment ..... *Middleton*
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We've Learned "You Can't Do That With Act. Sludge!" ..... *Mathews*

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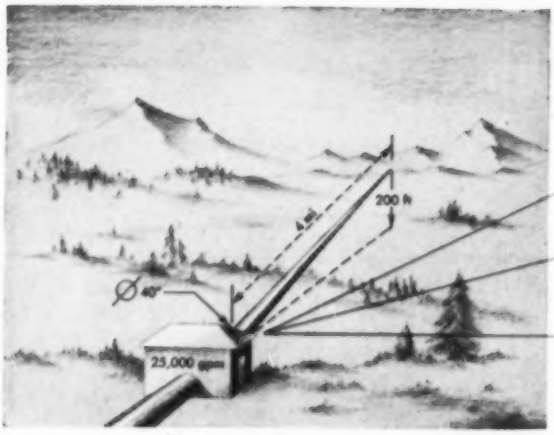
Published Monthly—subscriptions in the U.S., Canada and Latin America $2.00 per year; Foreign $3.00. Single copies 25c.
(Member—Audit Bureau of Circulation and Associated Business Publications, Inc.)



250 feet of head

525 feet of head

975 feet of head

?

CAN YOU PICK THE CORRECT ANSWER?

● **Here is the problem:** Estimate how high total pressure head could rise from surge if power failure brought the pump in this system to an abrupt stop.

25,000 gallons per minute are being pumped up an elevation of 200 feet in a total pipeline length of 4 miles. Pumping head is 250 feet. Pipe diameter is 40 inches. A check valve is used to stop backflow through the pump.

Make your guess, then here is the answer

Total pressure head could rise as high as 975 feet. Inertia of the upward moving column of water builds up great potential energy. As the water settles back against the check valve, a succession of dangerous pressure waves occurs, often sufficient to burst the pipeline.

THE PELTON SURGE SUPPRESSOR

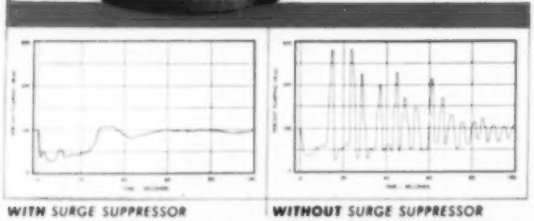
affords positive protection against this ever present danger — protection that no other valve gives.

Either current stoppage or pressure build-up actuates the **PELTON** Surge Suppressor. This quick-opening valve anticipates return surges and dissipates them by by-passing water around the pump; then it slowly closes as the pressure waves cease.

Lower pipeline costs can more than pay for a **PELTON** Surge Suppressor. Extra weight is eliminated because the pipe need not be designed with large safety factors in anticipation of high surge pressures. The possibility of line failures and interrupted service is greatly decreased.

Installations needing protection occur wherever water is pumped to a higher elevation either through a long pipeline or at high velocity. **PELTON** Surge Suppressors can be furnished to protect waterlines of any size handling service pressures up to 800 p.s.i.

Send us ***your*** *problem and include pipeline profile. Our engineers will make recommendations without obligation.*



***WITH** SURGE SUPPRESSOR* ***WITHOUT** SURGE SUPPRESSOR*

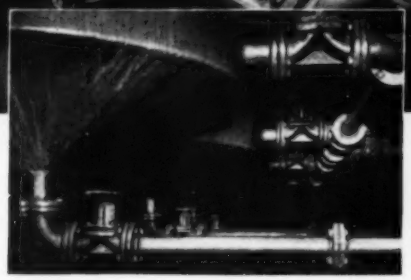
The PELTON WATER WHEEL Company

Subsidiary of Baldwin-Lima-Hamilton Corporation

2929 NINETEENTH STREET • SAN FRANCISCO 10, CALIFORNIA

"Most troublesome part of Sewage Treatment...

is the final disposal of sludge", says W. E. White, Chief Design Engineer, Dept. of Public Works, Houston, Texas. Shown here in the Houston sludge disposal plant are two chain-wheel operated, 10-inch, rubber lined Grinnell-Saunders Valves, with neoprene diaphragms, handling filtrate from vacuum filters with a PH of 3.5 to 4. This filtrate is a 2% to 3% solution of Ferric Chloride on a 15" to 20" vacuum. Temperature is atmospheric.



◀ In same plant. Eight 3-inch rubber lined Grinnell-Saunders Diaphragm Valves, handling 8% to 10% Ferric Chloride, at atmospheric temperature

OPEN CLOSED

A job well-suited to

GRINNELL-SAUNDERS DIAPHRAGM VALVES

Streamlined flow. Smooth, streamlined passage, without pockets, prevents trapping of solids. Frictional resistance is at a minimum — regardless of direction of fluid flow. No disc holder in fluid stream.

Leak-tight closure against grit, scale, suspended solids. The resilient diaphragm, plus the large area of contact, gives leak-tight closure against pressure or vacuum.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line. No sticking, clogging or corroding of working parts. Valve lubricant cannot contaminate fluids.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.

GRINNELL

WHENEVER PIPING IS INVOLVED

Write for Grinnell-Saunders Diaphragm Valve Catalog

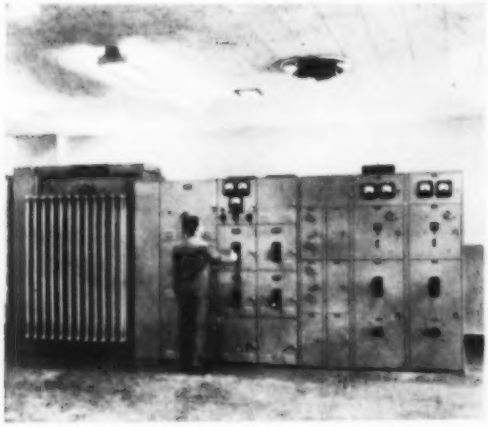
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

ENGINEERING REPORTS:

1 **COMPLETELY ENCLOSED OPERATION** at San Francisco's North Point plant represents a modern trend in treatment-plant design. Attractive appearance and air purification make such a plant a good neighbor in any industrial area. M. & K. Corp., Stolte, Inc., Fred J. Early, Inc., and Haas & Rothschild acted jointly as general contractors for the plant. Electrical contractors were Pacific Electrical and Mechanical Co., Inc. and Del Monte Electric Co.

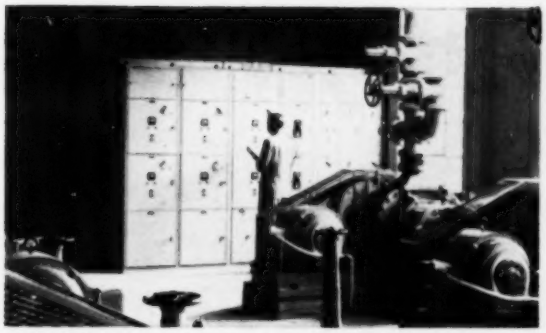
San Francisco continues its



6 **RELIABLE AND ECONOMICAL** power distribution is provided by G-E load-center unit substation (with Cabinetrol), one of two which supply 480-volt power for small process motors.

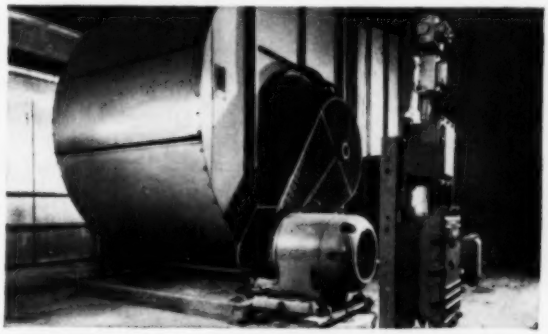
7 **MAIN CONTROL ROOM,** completely G-E equipped, houses line-up of main plant switchgear and limitamp control. Field rheostats and exciters for lift-pump motors are at left.

2 **CHLORINE CONTROL PANEL,** specially assembled by G-E., makes it easy to adjust output of plant's six chlorinators to match influent rate.



4 **SIX BLOWERS,** supplying all air for preaeration process, are each driven by a 40-hp G-E Tri-Clad* motor. G-E Cabinetrol* panel in background provides central control and protection of these motors.

3 **IN PRE-TREATMENT** and grit-removal building, small G-E totally enclosed motors drive sand collector and cross scraper, and grit-channel scraper.



5 **EXHAUST FANS,** driven by G-E totally-enclosed motors, are located in all buildings to prevent accumulation of nauseous and inflammable fumes. Air is treated with chlorophyll before discharge.

CLEAN WATERS program

New North Point treatment plant is major step in plan permitting development of waterfront recreation areas

Recent opening of San Francisco's new North Point Sewage Treatment Plant marks the completion of the largest single unit in a planned 21-plant pollution control system for the city. According to City Engineer Ralph G. Wadsworth, the new 150-mgd plant, in conjunction with others, will make possible the development of safe, attractive bathing and boating areas and will result in general improvement of the entire waterfront.

San Francisco chose efficient, long-life General Electric equipment for a large part of North Point's electrical system. In addition, G-E application engineers worked closely with city engineers to help design an electrical system exactly tailored to the requirements of the new plant.

Specialists in sewage-plant electrification, G-E application engineers are ready to work with *your* engineers or consultants, too. Backed by unexcelled engineering facilities, they'll help in designing a coordinated electrical system for your new plant or modernization project. Contact your local G-E Apparatus Sales Office early in the planning stage. General Electric Company, Schenectady 5, N. Y. 660-73

*Registered trade-mark of General Electric Company

Engineered Electrical Systems for Sewage Plants

GENERAL ELECTRIC

This pipe saves tax dollars

Generations of taxpayers have been saved millions in taxes by the long life of cast iron pipe in America's water distribution systems. For example, more than 35 cities have cast iron mains in service that were installed over a century ago.

Yes, cast iron pipe has saved, and is today saving, millions in tax dollars—but that is not all. Street excavations to replace short-lived pipe cost money in disruption to traffic and retail trade, not to mention the expense of installing new pipe and repairing costly pavement. Cast iron pipe saves these avoidable costs. And the dependable service of cast iron mains in high-pressure fire-fighting systems has saved millions in fire losses. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 South Michigan Ave., Chicago 3, Illinois.

This cast iron water main installed in Alexandria, Virginia, 100 years ago is still rendering satisfactory service. Over 35 other American cities have century-old cast iron mains in service.

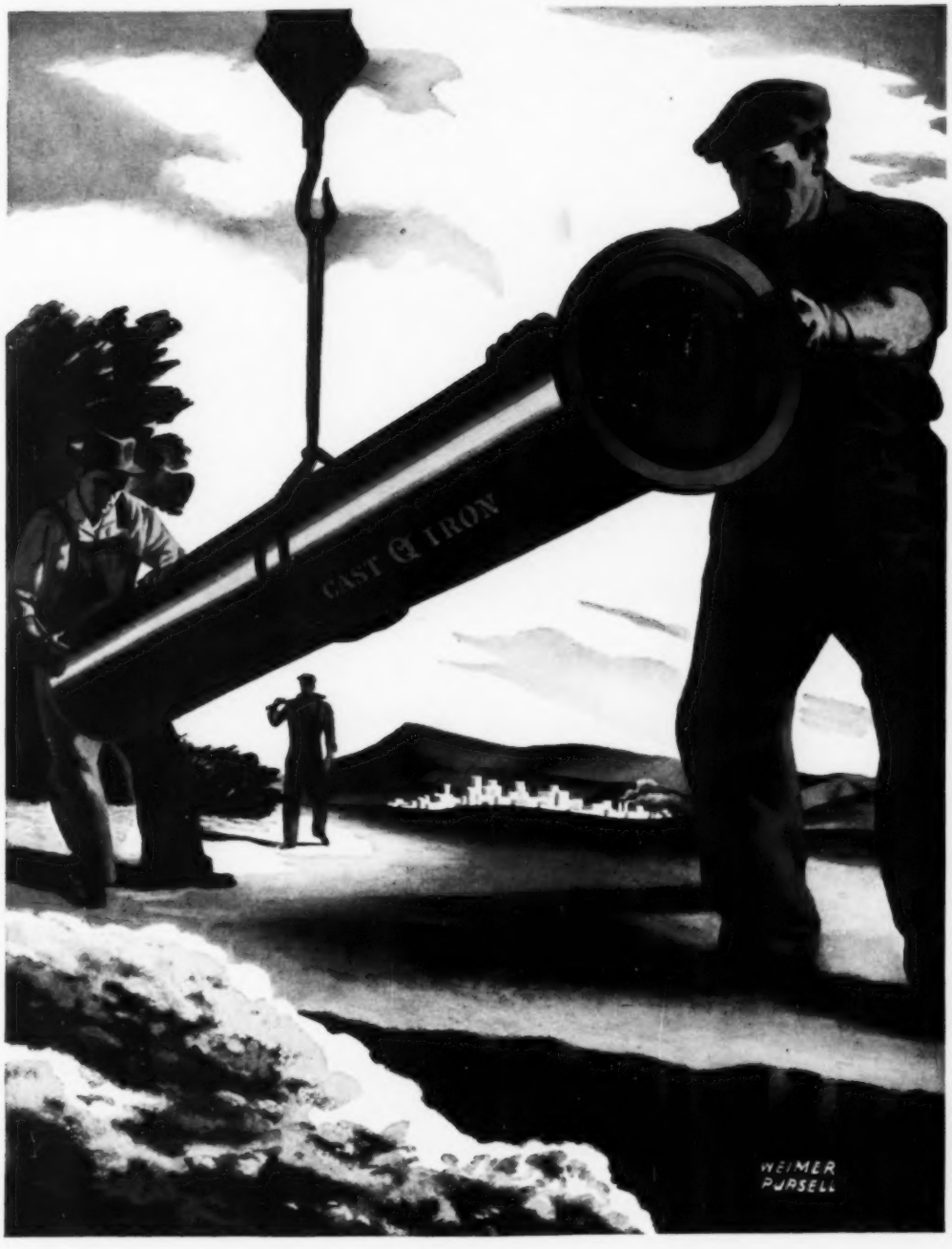
CAST IRON

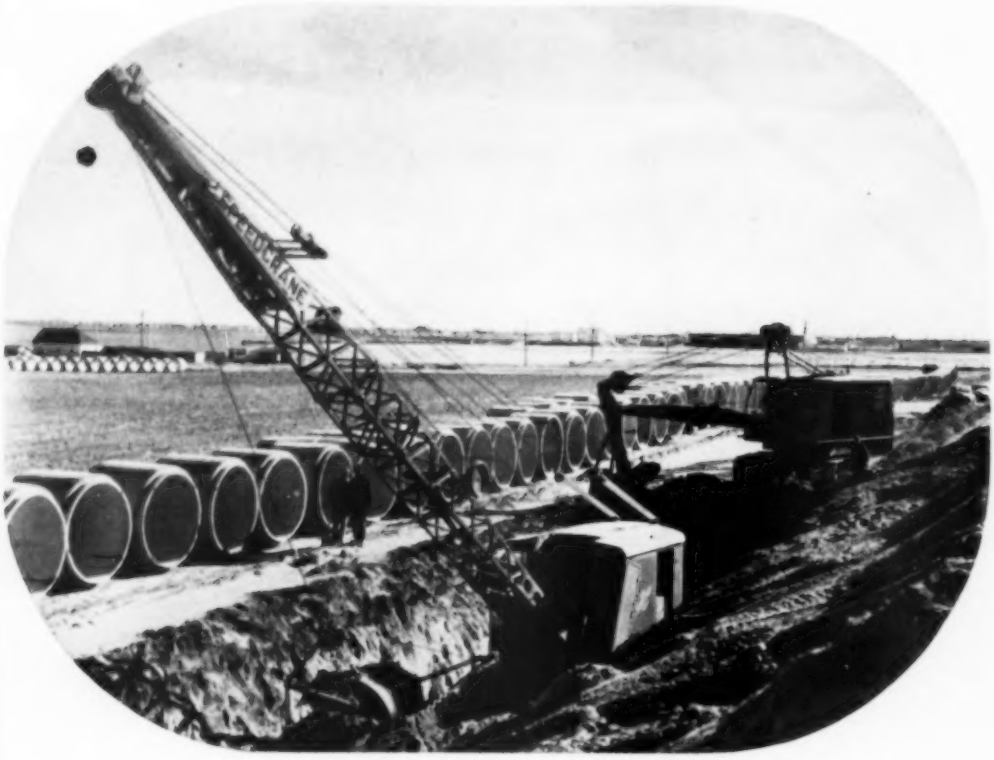
CAST IRON PIPE

America's No.1 Tax Saver

©1952, Cast Iron Pipe Research Association

— but that is not all





Denver builds gigantic storm sewer with 9 miles of *CONCRETE PIPE*

To encourage orderly growth Denver is developing a new addition of 1700 acres—70 per cent for residential and 30 per cent for industrial expansion. To serve this area the city installed the new Northeast storm sewer—using over nine miles of concrete pipe.

The photo above shows a trench being dug 20 ft. deep for 72-in. pipe. All the pipe was placed in open trenches. The sizes and quantities of concrete pipe used in the job are listed at right.

Hundreds of other cities from coast to coast have found that concrete pipe carries off large volumes of water efficiently. Concrete pipe has the strength to resist severe impact and sustain heavy overburdens. Its smooth interior resists abrasion and provides maximum hydraulic capacity. It is moderate in first cost and has the durability to render long years of service with little or no upkeep expense. The result is ***low-annual-cost*** sewer service.

Sizes and Quantities of Concrete Pipe in Northeast Storm Sewer

7,780 ft.	of 72 in. dia.
315 ft.	of 66 in. dia.
4,020 ft.	of 60 in. dia.
5,565 ft.	of 54 in. dia.
12,480 ft.	of 48 in. dia.
6,060 ft.	of 42 in. dia.
4,436 ft.	of 36 in. dia.
912 ft.	of 33 in. dia.
340 ft.	of 27 in. dia.
672 ft.	of 24 in. dia.
700 ft.	of 21 in. dia.
5,552 ft.	of 12 in. dia.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

a Background for BETTER WATER SERVICE

Water pressures increased 25-28 pounds per square inch and greatly increased storage capacity . . . that is part of the background story on the 50 ft. diameter by 78 ft. Horton standpipe recently installed in residential Mount Holly, New Jersey.

The structure is a standard Horton steel standpipe used the world over for improved water storage. Notice how it becomes a pleasing part of the landscape in the area where it is installed. This blending of landscape, dwelling and standpipe didn't happen by chance. Like all Horton structures, this welded steel tank was designed to be pleasing in appearance as well as functional in operation.

Horton welded steel reservoirs and standpipes are built in standard capacities up to 10,000,000 gallons and elevated water tanks are available in standard capacities from 5,000 to 3,000,000 gallons. Investigate the use of Horton tanks when you plan to improve your municipal water system. We shall be glad to furnish estimating figures to private water companies, consulting engineers and municipal officials without obligation. When writing please state capacity required, height to bottom and location.

The illustration at the top of this page shows a 50 ft. diameter by 78 ft. standpipe built by the Chicago Bridge & Iron Company for the Mount Holly Water Company at Mount Holly, New Jersey.

HORTON

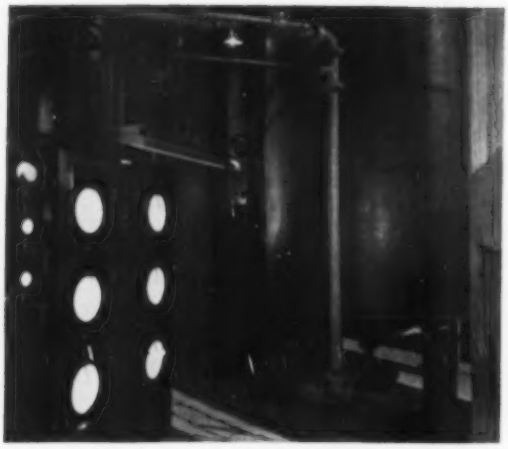
WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

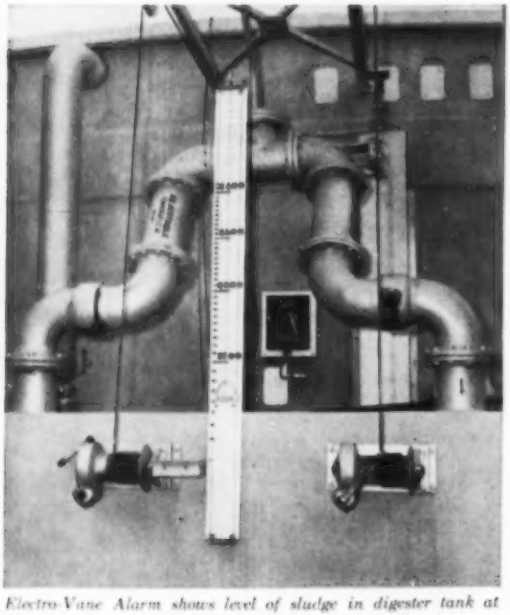
Atlanta 3	2181 Healey Bldg.	Los Angeles 17	1555 General Petroleum Bldg.
Birmingham 1	1586 North Fiftieth St.	New York 6	3390—165 Broadway Bldg.
Boston 10	1048—201 Devonshire St.	Philadelphia 3	1644—1700 Walnut Street Bldg.
Chicago 4	2198 McCormick Bldg.	San Francisco 4	1583—200 Bush St.
Cleveland 15	2262 Guildhall Bldg.	Seattle 1	1350 Henry Bldg.
Detroit 26	1551 Lafayette Bldg.	Tulsa 3	1646 Hunt Bldg.
Houston 2	2115 C. & I. Life Bldg.	Washington 6, D. C.	1109 Cafritz Bldg.



Brown instruments on this panelboard measure and control temperature and liquid level in decanters at Cooper-Bessemer Corp., Grove City, Pa.

Modern waste plants prefer

BROWN LIQUID LEVEL GAUGES



Electro-Vane Alarm shows level of sludge in digester tank at Hyperion Activated Sludge Plant, Los Angeles, California.

because . . .

. . . Accurate, sensitive level measurements make it possible to operate digesters, decanters and other equipment at top capacity.

. . . Wide range of measuring systems fits the needs of any waste-treating plant; includes electric and pneumatic transmission, electric or pneumatic control.

. . . Rugged construction and easy accessibility of parts reduces maintenance to a minimum.

. . . Multiple-pen instruments combine liquid level, pressure and temperature records on a single chart.

. . . Variety of signalling arrangements can be incorporated for actuating high and low level alarms.

Call in your local Honeywell engineering representative for a discussion of liquid level measuring, recording and controlling in *your* plant . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

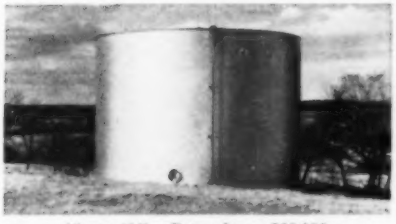
● *Important Reference Data*

WRITE FOR CATALOGS 7000 AND 7301

Low Cost EFFICIENT WATER STORAGE
-at natural elevations

Worcester, Mass.—Ellipsoidal roof type, 1,500,000 gallons capacity.

* *Steel Reservoirs*



Liberty, N.Y.—Flat roof type, 300,000 gallons capacity.

St. Paul, Minn.—Ellipsoidal roof type, 2,000,000 gallons capacity.

by PITTSBURGH • DES MOINES

The advantages of strength, simplicity, and economy of construction make Pittsburgh-Des Moines Steel Reservoirs your outstanding choice for water storage where elevated sites are available.

Durable for a lifetime, guaranteed in design, workmanship and material, P-DM Steel Reservoirs are built in flat-, dome-, or ellipsoidal-roof types, unornamented, or with pilasters and other architectural features as specified. *Write for our latest descriptive Steel Reservoir Bulletin.*

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3418 Neville Island	DES MOINES (8)	919 Tuttle Street
NEWARK (2)	218 Industrial Office Bldg.	DALLAS (1)	1223 Praetorian Building
CHICAGO (3)	1222 First National Bank Bldg.	SEATTLE	526 Lane Street
LOS ANGELES (48)	6399 Wilshire Blvd.	SANTA CLARA, CAL.	625 Alviso Road

Another town is thrifty in choosing **"CENTURY"** *asbestos-cement pipe*

This scene—showing a "Century" Pipe installation—could have been made in any of a hundred municipalities throughout the nation. For each year, more and more cost-conscious communities are laying water mains of "Century" Asbestos-Cement Pressure Pipe.

The reasons are as plain as the "one" on a dollar bill. "Century" Pipe is light in weight, easy to handle, yet inherently strong. It can be laid quickly and efficiently. "Century" Simplex Couplings make short work of the joints, too. With these couplings, curves up to 5° deflection per pipe length are taken easily, fewer special bends are necessary, and flexural strains due to settlement or trench loading are minimized.

But the best part comes later! After years and years of service, "Century" Pipe retains its original carrying capacity—because it never tuberculates, rusts or corrodes. It is non-metallic and highly resistant to corrosive soils. In fact, a "Century" water main actually increases in strength over the years.

You just can't beat such long-lasting economy! For *your* next water main, specify "Century" Asbestos-Cement Pressure Pipe.

FREE BOOKLET—*Mains without Maintenance*, gives valuable data, specifications, and reference material on water main pipes. Write for your copy today.

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873.

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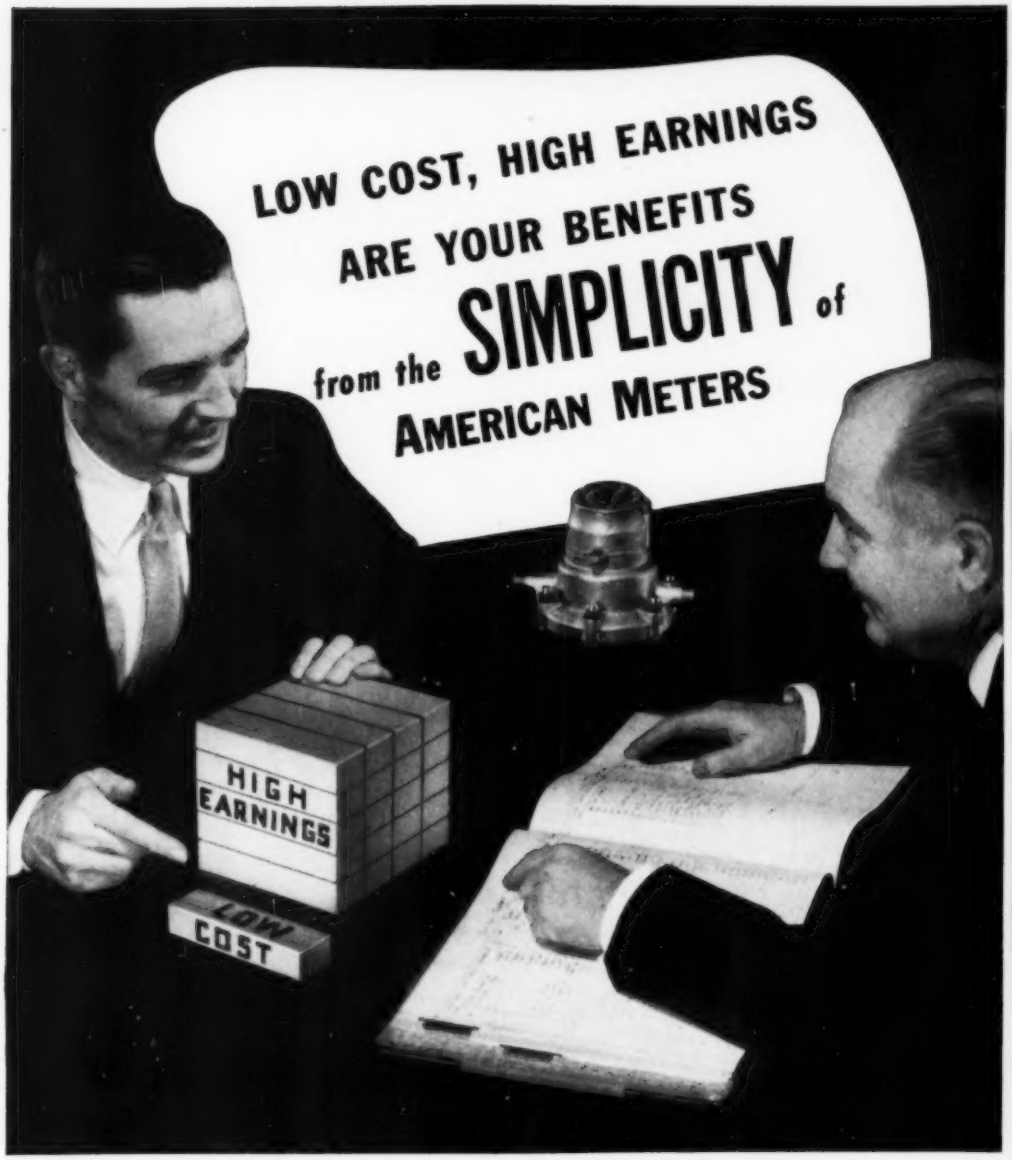

• American Meters are accurate and operate for decades without attention. They earn full revenue for you at low first cost and lowest maintenance cost. This is due to the simplicity of design—fewer parts—simpler castings—reduced opportunity for failure. American Meters have become a standard in hundreds of communities – cities and villages – and are giving full value.

BUFFALO METER CO.

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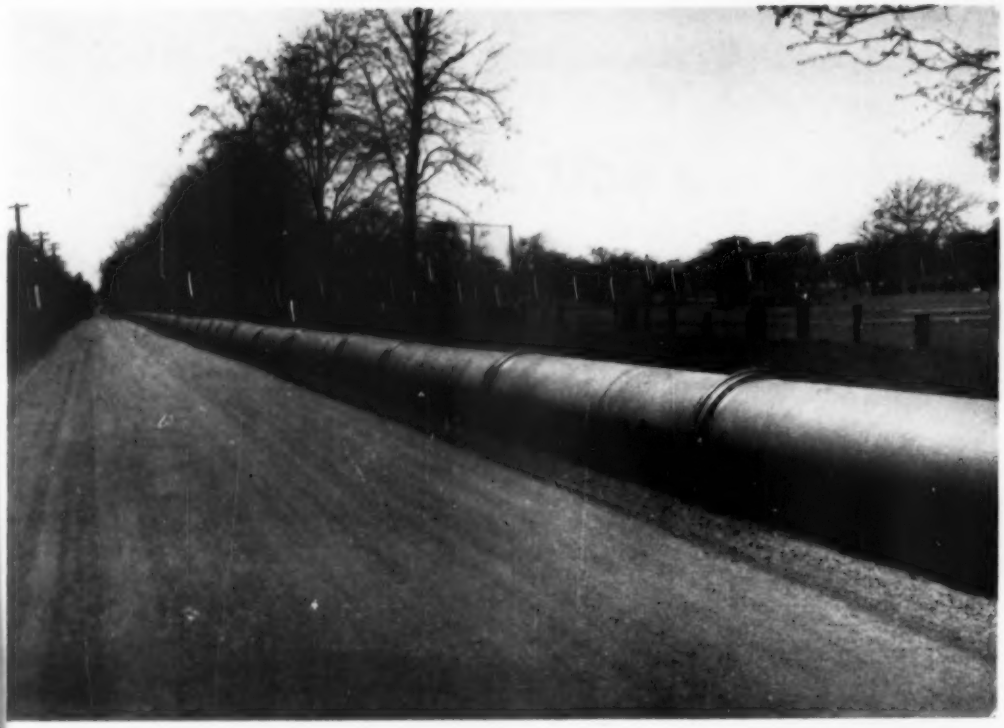

MONO-CAST Pipe for Every Service Condition

Modern usage is continually making increasingly severe demands on pipe lines. Underground mains must do much more than merely resist corrosion. They must convey greater volumes, at higher internal pressures; they must withstand vastly increased external loadings; they must be adapted to an ever-widening range of service conditions. Mono-Cast Pipe possesses the exceptional physical strength and uniformity necessary to meet these requirements.

Mono-Cast pipe is manufactured under rigid specifications in diameters 3-inch through 48-inch. It is corrosion resistant, will stand the impact of heavy loads and gives complete job satisfaction. This pipe is manufactured in specific weights for specific laying conditions. You get the exact pipe your conditions require.

It is conveying water, gas, crude oil, gasoline, sour naphtha, salt brine, Foamite fire foam, ashes—and in fact, just about everything that a pipe line can conceivably convey. It is conveying these products under operating pressures ranging from a few pounds to the square inch, up to pressures in excess of 100 pounds gas and 500 pounds liquid.

Mono-Cast Pipe serves equally well beneath crowded city streets or in cross country installations, like the one shown above.

Being cast iron, Mono-Cast Pipe enjoys an enviable reputation. Cast iron pipe has had over three hundred years of service abroad and more than one hundred years of service in the United States. It is satisfactorily serving in locations where especially severe external and internal corrosion conditions exist. Mono-Cast Pipe is designed to give super-service and its wide acceptance and splendid performance bespeak its excellence and the confidence and esteem in which it is held by those who are using it.

Refer your next piping job to ACIPCO, and utilize the extensive manufacturing facilities of the largest individual cast iron pipe foundry in America.

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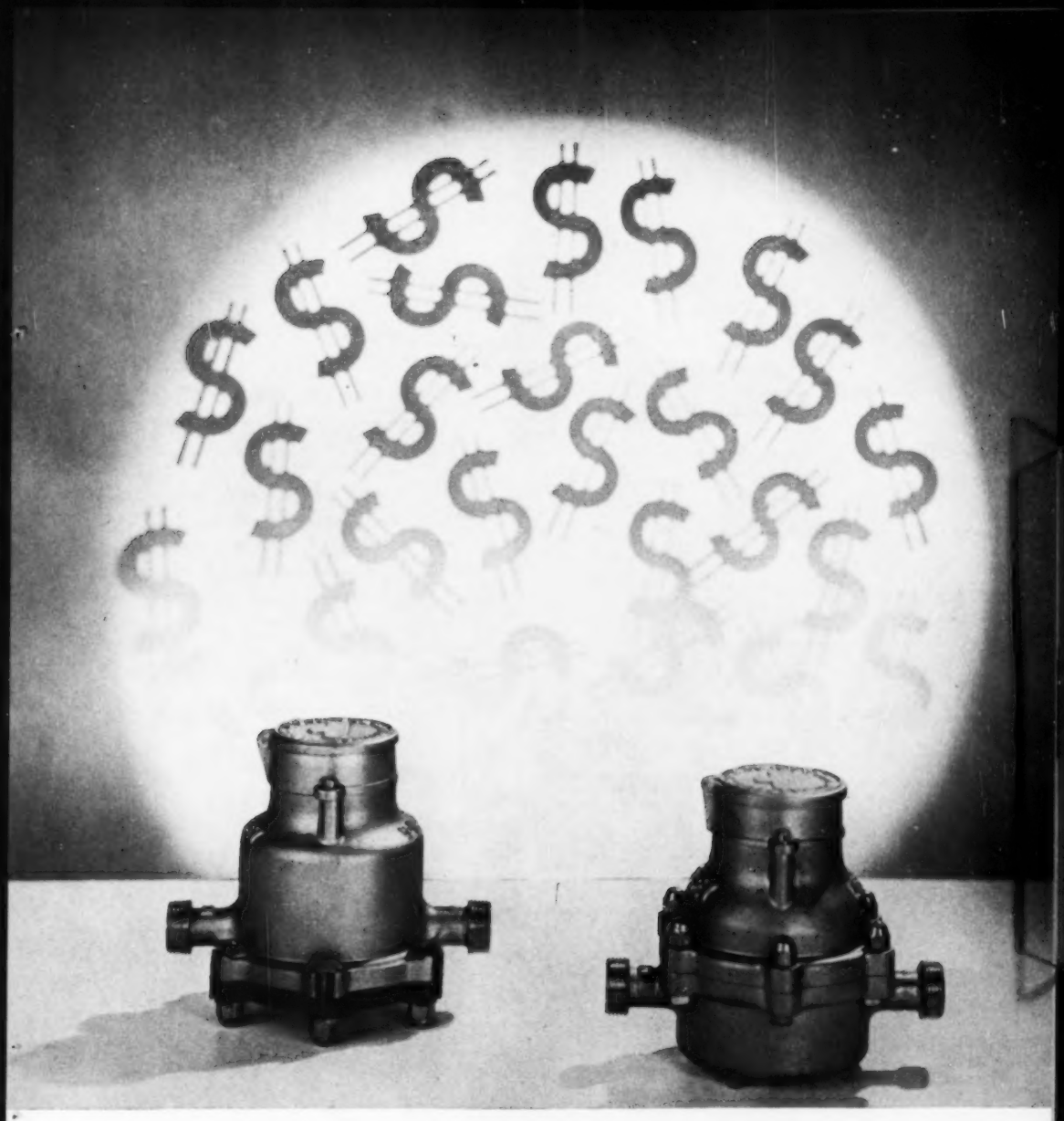

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will give you the most service for every Dollar invested

Ask the experienced Water Works Engineer — he knows

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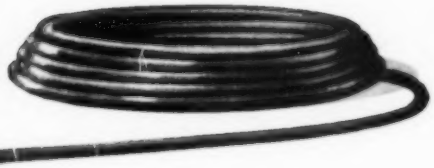

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Write today for literature.

CARLON IS FLEXIBLE!
EVERY FOOT IS FACTORY TESTED!
STRIPED FOR POSITIVE IDENTIFICATION
LENGTHS UP TO 400 FEET
GUARANTEED AGAINST ROT, RUST AND CORROSION
SMOOTH INNER WALLS CUT FRICTION LOSS
LOOK FOR THIS EMBLEM ON ALL CARLON FITTINGS!
IT'S LIGHTWEIGHT
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Announcing the new bulletin describing the HAGAN DIFFERENTIAL TRANSMITTER

(TYPE FRB RING BALANCE)

The Hagan Type FRB Differential Transmitter produces pneumatic output signals which are linear with the pressure differential measured.

This transmitter can be used for generating output signal pressure under the wide range of differential and static pressure conditions, for both liquids and gases, common to the process industries, metallurgical furnace and steam plants.

Bulletin 3M-52 tells you about the Hagan Type FRB Differential Transmitter and what it does. It is yours for the asking.

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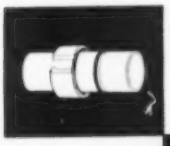
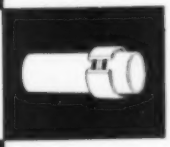
WS-11

. . . it's the *tight* RING-TITE JOINT used with TRANSITE SEWER PIPE

HERE'S HOW THE RING-TITE JOINT WORKS:



◀ **Start of assembly.** Two rubber rings and a Transite sleeve (cut away to show position of the rings) are placed on one of the two pipe ends to be joined.



▶ **Final position.** Sleeve centered over both pipe ends, with the rubber rings tightly compressed between sleeve and pipe.

◀ **Checking joint** for proper assembly. This is done with a simple gauge immediately after the joint is made . . . *before backfilling.*

Not only is it possible to assemble the new Ring-Tite Coupling in a fraction of the time required for making ordinary sewer pipe joints—but, with the use of a simple feeler gauge, you can check this joint for proper assembly as soon as it is made, *and backfill immediately!*

This "packaged" joint—furnished with Transite* Pipe and ready for assembly—has still other important practical advantages. Not only are there fewer joints to make due to long thirteen-foot lengths, but time is saved also by eliminating the use of poured compounds. Just a simple assembly operation with a mechanical coupling puller, and the Ring-Tite Joint is ready for service.

Its tightness means less infiltration in the sewerage system and this effects savings in treatment costs. Transite's high-flow capacity (Manning's n = .010) often results in substantial installation savings by permitting flatter grades and shallower trenches—an important economy where pipe is laid at or below the ground water table or in rock excavation.

For further data about this corrosion-resistant asbestos-cement pipe and how it can save money for you, write for Folder TR-103A. Address your inquiry to Johns-Manville, Box 60, New York 16, N.Y.

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE SEWER PIPE

LEBANON, N. H.

Lebanon Water Works

(MODERNIZATION COMPLETED IN 1951)

CAMP, DRESSER & McKEE
Consulting Engineers
Boston, Mass.

HARRY MANSON, *Supt.*
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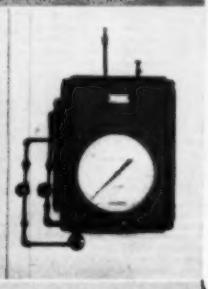
Lebanon, N. H.



Builders Water Works Equipment furnished for the modernization program at the Lebanon Water Works:

- **12" Orifice Plate with Flo-Watch Indicator**
- **8" Rate Controllers with Loss-of-head and Rate-of-flow Indicating Gauges**
- **Filter Operating Tables**

Size is no measure of the efficiency of a water works. The Lebanon Water Works, while designed to handle only approximately 3 MGD in supplying a population of 4,581, is now equipped with the same modern instruments, controls, and treatment facilities employed in the largest water works in the country. A recently completed improvement program has effected a 50% increase in plant capacity and now permits 24-hour operation without the necessity of continuous attendance on the part of the operating personnel.

Builders Flow Meters, Controllers, Gauges, and Filter Operating Tables — installed by Randall Company, Inc. of Rutland, Vermont — constitute an important part of this modernization program. This equipment assists in maintaining efficient flow conditions throughout the plant at all seasons of the year.

For Bulletins describing Builders Water Works Equipment, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, Rhode Island.

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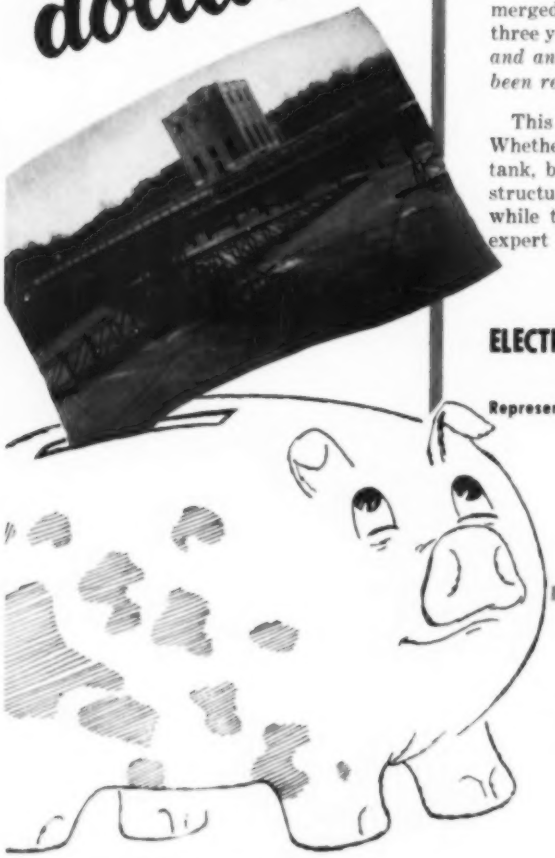
BUILDERS PROVIDENCE *Instruments*

BUILDERS

how to save... a quarter million dollars



Water Works equipment has to be in A-1 operating condition all the time. Repair and maintenance shutdowns often involve inconvenient delays, costly materials and the use of substitute equipment. One of the greatest causes of these shutdowns is corrosion of equipment. A large mid-western city recently was faced with such a problem. Within eight years after the plant was placed in operation, the submerged steel showed active corrosion of alarming proportions—the warning of a possible loss of a quarter million dollar investment. Various coatings were tested for possible application, but none of those tested was considered satisfactory.

It was then that the ERP man was called in. At approximately half the cost of sand blasting and coating, and with no surface preparation or long outage time, an ERP cathodic protection system was installed to protect all submerged steel in the treatment equipment. After three years *there has been no further corrosion, and an appreciable saving in maintenance has been realized!*

This is a typical example of ERP at work. Whether your corrosion problem involves a tank, basin, deep well, water works treatment structure, or pipe line it will be worth your while to discuss it with your ERP man. His expert advice may save you *dollars* tomorrow.

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Represented in Principal Cities in the United States

COMPLETE CATHODIC PROTECTION SERVICE •
DESIGN
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Over 15 years of cathodic protection engineering, research and development

E-23

FIELD TEST REPORT

Aqua Nuchar Less Expensive Than Masking Agent For Correcting Odor In Process Water

PROBLEM:

A paper board company uses a coastal river as its source of water in their manufacturing process. The process water intake is located in the tidewater section and the water is highly colored, turbid and odorous. Threshold odor values range from 20 to 8,000 and the water contains approximately 35 ppm of salt.

Since a good portion of this paper board is used for food packaging, it is necessary to guard against objectional odors in the paper. Production records show that the process water can have a threshold odor number of 50 and still not noticeably affect the quality of the water. However, when the threshold number exceeds 50, the odor must be reduced or masked, to avoid customer complaints.

SOLUTION:

The company had been using a masking agent for correcting the odor conditions. The shortcomings of this method are that it is not always effective, particularly during high odor concentrations, and masking does not remove the odor bodies, as Aqua Nuchar Activated Carbon does, but actually adds another compound to the paper.

At the time that the Aqua Nuchar Threshold Odor Specialists visited the paper board plant, the water had a threshold value of 90. A laboratory study indicated that about 4 ppm Aqua Nuchar "A" would reduce the odor to the acceptable threshold odor number of 50. This dosage of Aqua Nuchar Activated Carbon amounted to about 2.5 cents per ton as compared to a cost of 15 cents per ton when the masking agent was used.

Write to our nearest office and arrange to have our Threshold Odor Specialists study your taste and odor problems.

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OTHER PRODUCTS: *Nuchar Activated Carbon—Liqro Crude Tall Oil—Tallene Tall Oil Pitch—Indusoil Distilled Tall Oil—Tallex Abietic Acid—Indulin (Lignin)*

Lieutenant Stanley T. Adams Medal of Honor

ONE BITING-COLD FEBRUARY NIGHT, Lieutenant Adams was on a bitterly contested hill near Sesim-ni, Korea. Out of the dark earth the silhouettes of some 150 Communist troops rose up against the skyline. Ordering fixed bayonets, the lieutenant, with only 13 men, leaped up and charged furiously against the overwhelming odds. He was knocked down by a bullet. At least three hand grenades actually bounced off his body before exploding nearby. But when Adams and his squad were through, there were only 50 Communists left on the hill – and they were dead.

"Nobody likes to kill," says Stanley Adams. "Nobody likes war. But today the surest way to invite a war is to be weak. You and I know that twice in the last ten years Americans have let their guard down. And the Philippine and Korean graveyards are filled with men who paid the price for it.

"Please don't make that tragic mistake again. Remember that in the world today, *peace is only for the strong*. Help make your country and your armed services stronger still – by buying more . . . and more . . . and more U. S. Defense Bonds. Put *your* bond-power behind *our* fire-power, *now* – and together we'll keep America at peace!"

* * *

Remember that when you're buying bonds for national defense, you're also building a personal reserve of cash savings. Remember, too, that if you don't save *regularly*, you generally don't save at all. So sign up today in the Payroll Savings Plan where you work, or the Bond-A-Month Plan where you bank. For your country's security, and your own, buy U. S. Defense Bonds now!

Peace is for the strong... Buy U.S. Defense Bonds now!

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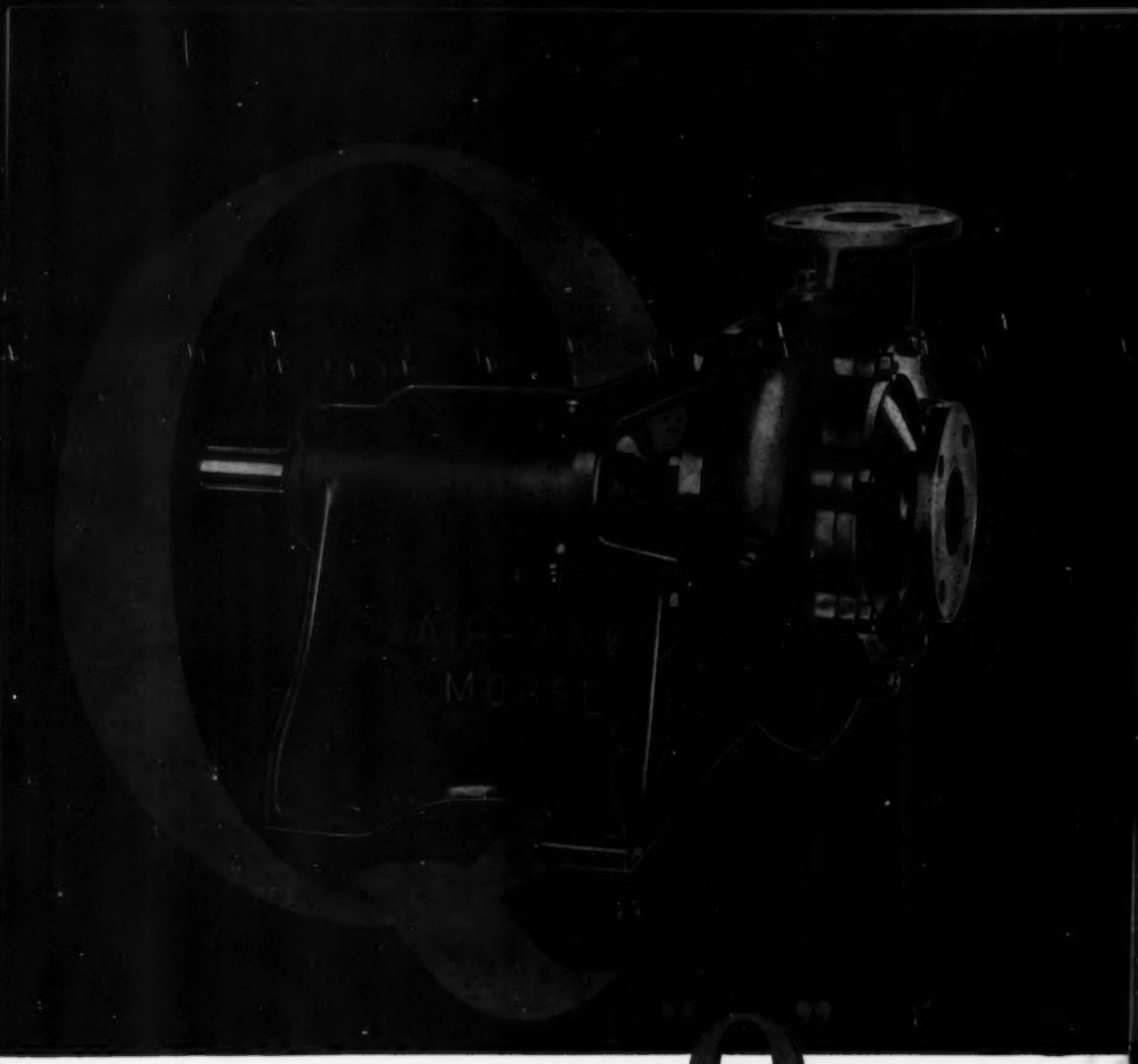
WATER & SEWAGE WORKS



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Quality . . . that costs no more is yours when you choose Fairbanks-Morse Side Suction Centrifugal Pumps. Extensive engineering laboratories . . . production line methods with precision machining of all parts enable Fairbanks-Morse to offer you a side suction centrifugal with the design, workmanship and performance normally obtained only in highest quality split-case pumps.

Open type, single suction, high efficiency impeller . . . ball-bearing frame construction for long life and smooth operation . . . one-piece, solid cast frame . . . close-grained smooth cast iron volute . . . are among the many big pump features you'll find in these moderate priced side suction centrifugals.

For a "cue" to better pump performance, choose the pumps that spell quality with a capital "Q" . . . Fairbanks-Morse Side Suction Centrifugals. Fairbanks, Morse & Co., 600 S. Michigan, Chicago 5, Ill.

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a name worth remembering when you want the best

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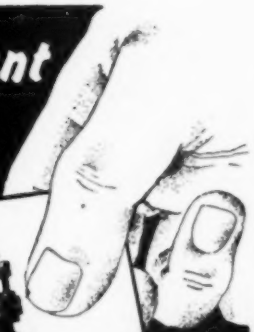
there's an EDDY valve or hydrant to fit the pipe in your water distribution system...



EDDY BELL END VALVE

EDDY BRONZE MOUNTED GATE VALVES

offer simplicity of design, trouble-free operation and enduring service. From the engineering drawing boards through all stages of manufacture, they are step by step a truly "finished" product of workmanship. These factors, added to personal experience, are reasons why progressive water works men have relied on Eddy Valves for years.

EDDY MECHANICAL JOINT VALVE

Two unskilled workmen, using only a ratchet wrench, can quickly install the Eddy Mechanical Joint Valve. Work can be done in a flooded trench or under any weather conditions, for no caulking, no lead-melting is necessary. Every joint is held bottle-tight under pressure. Available in sizes from 3 to 12" for use on both centrifugally-cast and sand-cast pipe.

EDDY BELL END HYDRANT

EDDY BRONZE MOUNTED HYDRANTS

are built for dependability and lasting service. They open smoothly *with* the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safe-guarding against freeze-ups. Stem held in place below main valve means no water loss due to a bent stem.

Equipped with mechanical joint connection, Eddy Hydrants can be quickly installed, requiring a minimum amount of labor. A ratchet wrench is the only tool needed. Available with or without auxiliary valve.

EDDY MECHANICAL JOINT HYDRANT

Send today for full information on the complete line of Eddy Valves and Hydrants. No obligation.

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VALVE COMPANY

A Subsidiary of James B. Clow & Sons

WATERFORD, NEW YORK

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FLORIDA FRUIT CONCENTRATE
Cooperative

6,500 GALLONS PER MINUTE!.....

To be sure of always having an adequate, fully dependable and surprisingly economical supply of water, the Fosgate Citrus Concentrate Co-operative installed Layne Wells and Pumps at their new plant near Orlando, Florida. Their two units:—one 24-inches and the other 14-inches in diameter have a capacity of 6,500 gallons per minute—or 9,360,000 gallons daily if operated on a 24-hour basis. Built to Layne's standard of precision engineering, these wells and pumps will give years and years of excellent service with an amazingly low maintenance cost.

The same "know-how" experience that built a fine water supply for the Fosgate people of Florida—and for several thousand other plants, cities and factories,—is ready to serve you, whether for a single small unit,—or a number of large ones.

Layne

For Layne's Catalog on Well Water Systems write—

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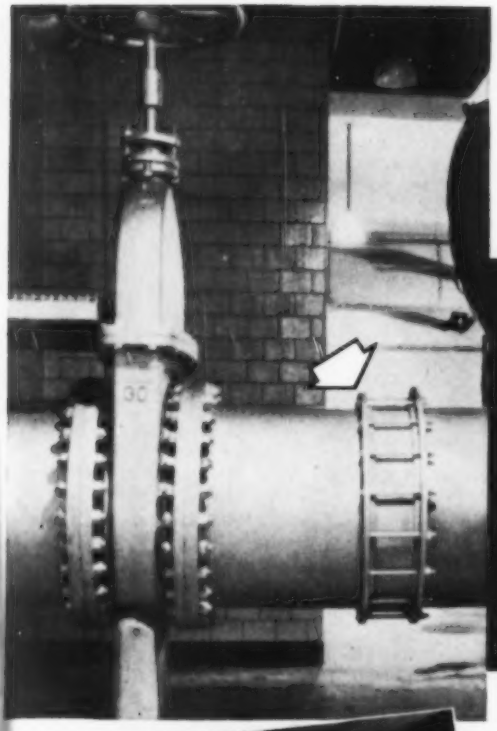
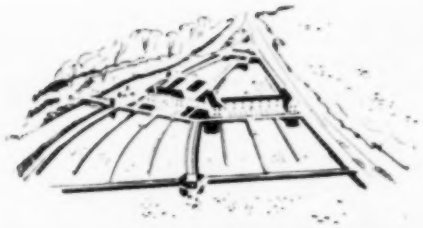
WATER WELLS
VERTICAL TURBINE PUMPS
WATER TREATMENT





at Richmond, Virginia...

DRESSER COUPLINGS *Safeguard Big Valves*

Marsden C. Smith, Richmond's Chief Water Engineer, writing in *Water & Sewage Works*, says, "The design of the large valves controlling the filters in our No. 2 Purification Plant has been greatly improved by the use of 'plain ends' connected by flexible couplings. This eliminates dangerous stresses on the valve bodies, due to expansion and contraction, and also provides a simple means of replacing the valve, or its removal for repairs."

Dresser Couplings make big-pipe installations easier, faster . . . even in close, cramped quarters. Dressers can give or take as much as 3/8", deflect as much as 4° or more.

Dresser Couplings eliminate expensive maintenance . . . assure lifelong dependability.

Complicated, close-quarter piping at Richmond was simplified by Dressers. Required no exact pipe fitting, absorbed pipe movement without leakage.

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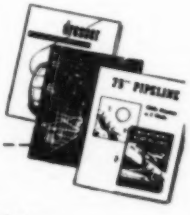
Let us send you Dresser engineering installation reports, with facts and figures that may help you. Mail the coupon below.



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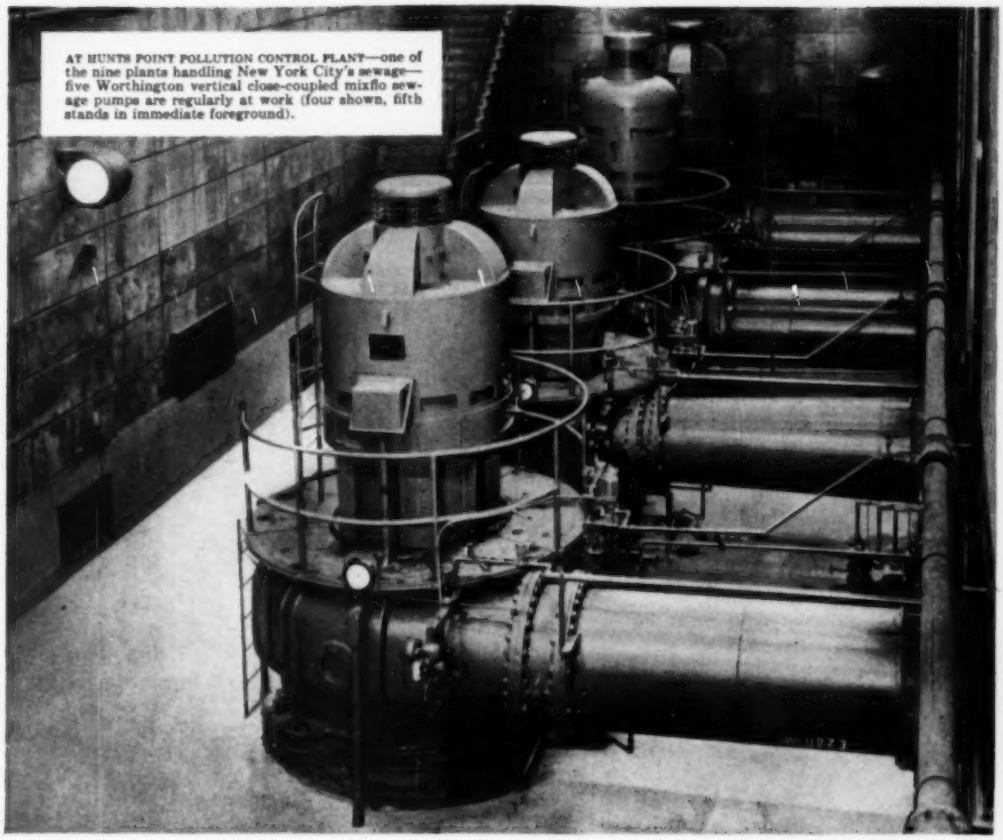
59 Fisher Avenue, Bradford, Pennsylvania
(One of the Dresser Industries)



AT HUNTS POINT POLLUTION CONTROL PLANT—one of the nine plants handling New York City's sewage—five Worthington vertical close-coupled mixflo sewage pumps are regularly at work (four shown, fifth stands in immediate foreground).

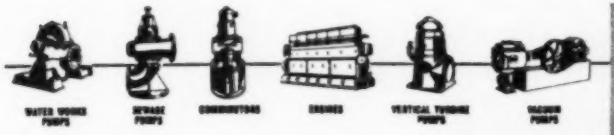
1689 mgd of New York City's Treated Sewage handled by Worthington pumps

If you want to see Worthington sewage pumps—large and small—at work, you can't go wrong by looking inside six of the nine major disposal plants that serve the City of New York. A total of 1689 mgd installed capacity of Worthington sewage pumps are now in regular use in the world's largest city.

New York's installed capacity of sewage pumps is among the largest in the U. S., so you'd naturally expect the city's public works officials to be familiar with Worthington performance—performance that years ago gave Worthington its position as world leader in the manufacture of pumping equipment.

Hundreds of *smaller* municipalities across the country know Worthington, too, not only for sewage pumps but for water-works pumps, comminutors, engines and other public works equipment. *Worthington Corporation, Public Works Division, Harrison, New Jersey.*

W.2.3



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IOWA
MECHANICAL JOINT FIRE HYDRANTS

Replace Old, Inefficient Hydrants

.....BE READY FOR ANY EMERGENCY!

Don't wait for disastrous fires to strike—regrets can't compensate for loss of life or property. Retire those worn-out and obsolete hydrants, eliminating costly repair jobs. Just dig up the old hydrant, melt out the lead joint, and install a new Iowa Mechanical Joint Fire Hydrant which is supplied with all necessary joint accessories... no lead, no jute or calking. These mechanical joints fit all kinds of cast iron pipe—a ratchet wrench is all that's needed to complete a "bottle-tight" joint. Fast, simple and economical.

Act now, before it's too late!
Write today for further details.

KEEP WORK CREWS BUSY ON JOBS LIKE THIS... IT PAYS!

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Sludge Bed Dries in Weeks Instead of Months ...with ENZYMATIC Treatment!

Drying bed of the Oakland, Missouri Disposal Plant, where Enzymatic boosted drying time to an "unbelievably rapid rate". City officials say, "Enzymatic is the most remarkable product we have ever tested . . . economically solves every problem our disposal system faced."

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14 WEEKS!

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Communities Report Astounding Results with New ENZYMATIC Product in Sewage Treatment Plants.

ENZYMATIC IS PERFORMANCE GUARANTEED!

- Completely eliminates or greatly reduces odors
- Reduces amount of sludge at least 30%
- Increases gas production—keeps it steady
- Liquefies and permits digestion of fats
- Makes sludge free-flowing
- Cleans spray nozzles—keeps them open
- Eliminates need for standby heating and fuel purchases
- Speeds sludge drying—to weeks instead of months
- Prevents "flop-over" and "sloughing off"

MAKE YOUR OWN TEST OF ENZYMATIC. Prove to your own satisfaction as hundreds of cities have done. Enzymatic is sold on a *performance guarantee.*

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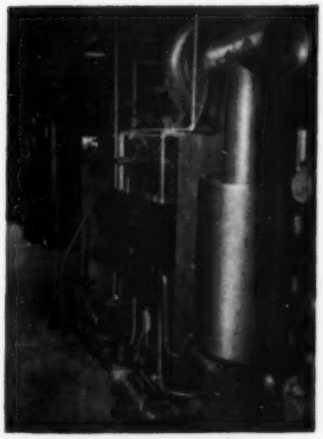

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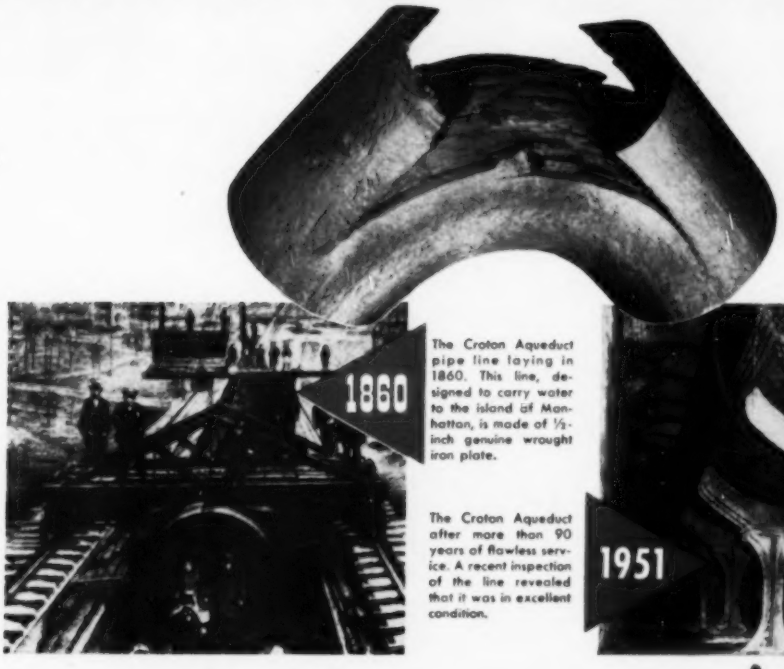

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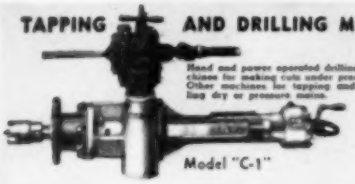

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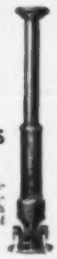

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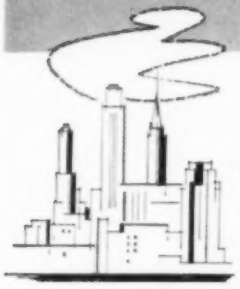

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2 — Fine bar screens, 1" openings.
2 — Screenings grinders, 2000# per hour each.
4 — Primary tanks each 102'-8" by 33'-6" by 12'-0", each tank equipped with two main collectors and one cross collector.
8 — 12" diameter rotating pipe scum skimmers.

JEFFREY EQUIPMENT

HUNTS POINT SEWAGE TREATMENT WORKS
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5 — Grit channels, each equipped with two scraper collectors and one V-bucket elevator.
5 — 12" diameter horizontal spiral conveyors.
5 — 12" diameter inclined spiral conveyors.
5 — 12" diameter inclined dewatering spiral conveyors.
5 — #9 JIGRIT washers, 280 cu. ft. per hour each.
4 — Primary tanks each 168'-0" by 108'-0" by 12'-3", each tank equipped with six main collectors and one cross collector.
16 — Final tanks each 94'-6" by 81'-0" by 14'-0", each tank equipped with four main collectors and one cross collector.
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4 — Screenings grinders, 2000# per hour each.
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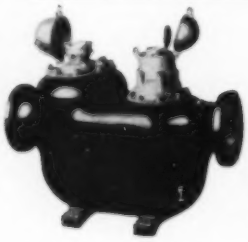

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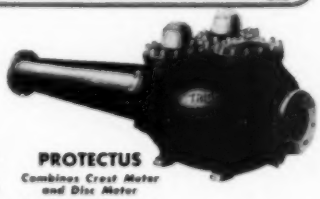

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WATER & SEWAGE WORKS

VOL. 99, NO. 11 • A GILLETTE PUBLICATION • NOVEMBER 1952

AMERICA'S LARGEST fluoridation installation is located in the tower of Washington's Dalecarlia Filtration Plant—see Fig. 2.

Norman E. Jackson

"The Washington Story of Fluoridation"

America's Largest Fluoridation Station Goes into Operation

by

NORMAN E. JACKSON, *Chief, Dalecarlia Section,* and*
EDWIN A. SCHMITT, *Chief, Water Supply Division,**
WASHINGTON, D.C.

Edwin A. Schmitt

THE water supply system of the District of Columbia and environs has two components: the Supply Division and the Distribution Division. The supply division, known as the "Washington Aqueduct," comprises the collection and purification systems consisting of dams, conduits, reservoirs, filtration plants, pumping stations, and transmission mains. The distribution division, known as the "Water Division," comprises pumping stations; high-service storage reservoirs and tanks; trunk, secondary, and service mains; fire hydrants; and service meters. The Supply Division is under the control of the Chief of Engineers, Department of the Army, and is operated by the Washington District Office of the Corps of Engineers, U. S. Army. The Distribution Division is under the control of the Commissioners of the District of Columbia and is operated by the Water Division of the Department of Sanitary Engineering.

Development of the Fluoridation Program

A fluoridation program for the public water supply of Washington, D. C. had its beginning in the Bureau of Dental Services of the District of Columbia Department of Health. The development of fluoridation was under careful observation by the professional personnel of this bureau some five to seven years before fluoridation was actually recommended for the D. C. Water Supply.

As a result of these activities the Bureau of Dental Services became convinced that fluoridation would be a program beneficial in the public interest.

When favorable resolutions were passed by Parent-Teacher Groups and Health and Civic Groups, and after favorable mail and press reaction developed, representing a wide cross section of the city's population, the Bureau of Dental Services on 21 March, 1951, sponsored a recommendation through the Director of Public Health to the governing Board of three District Commissioners that the water supply of Washington be fluoridated.

Deferral . . . Protest . . . Reinstatement . . . Reality!

On a recommendation by the Commissioner under whose jurisdiction the program lay, the Board of Commissioners on 29 March deferred favorable action. This recommendation was based largely on the cost of the program as viewed from the then current financial condition of the District of Columbia.

Deferral of action by the Board of Commissioners aroused considerable public interest. This interest was manifested in the press and in letters to the Health Department and to the

*Washington Aqueduct, Corps of Engineers, U.S. Army.

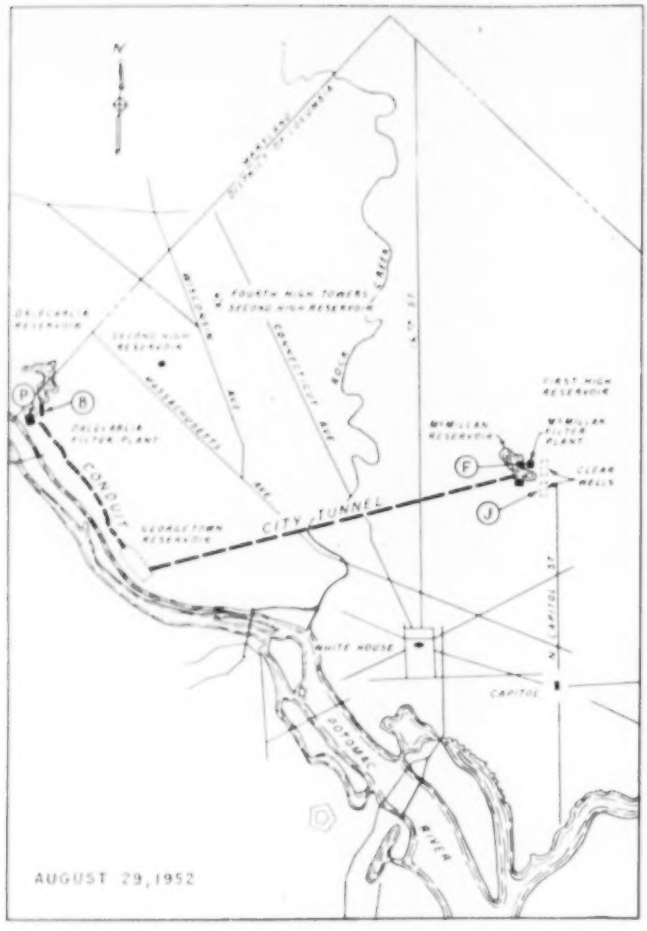


Fig. 1—Washington Aqueduct. Vicinity Map, showing location of plants and sampling points.

Board of Commissioners as favoring an early initiation of fluoridation.

The reaction was such that it led the Commissioner-in-Charge to instigate a further study of the matter and 14 May 1951 he took a favorable stand and recommended to the Board of Commissioners that the fluoridation program be approved and that the funds necessary for the project be added to the budget of the Water System.

The Senate Sub-Committee having the approval of the Commissioners and having heard the appeal of Civic Organizations and the Press, inserted a special appropriation of $130,000 in the District's budget for water fluoridation, although the regular budget had already been submitted to the Senate.

The Senate Committee on Appropriations approved the special appropriation which was in consequence approved by the House also.

On June 23, 1952 at 9:30 a.m. a brief ceremony was held at the Dalecarlia Filter Plant in which the Commissioners officially began fluoridation of the Washington water supply in the amount of 1 part per million.

Except for short stoppages for machine adjustments and minor repairs, there has been no interruption of this program since.

Planning Stage

In mid April 1951 when it appeared that fluoridation might become a reality studies to determine how fluoridation could best be accomplished were begun by the Water Supply Division, District of Columbia.

These studies culminated in a report entitled "Fluoridation of the District of Columbia Water Supply," which was issued in July 1951. The general plan of that report was based on two premises (1) that the best plan was one which provided for a complete and adequate fluoridation installation within the shortest time and with the least expense (2) that after a few years of experience in fluoridating the water if it was decided to discontinue or change the process it could be done with minimum loss of investment. Therefore, in order to implement these underlying principles, utilization of existing space and equipment insofar as practicable was the guiding thought behind the planning report.

Problems

A general recounting of some of the problems faced before submission of that report may be of interest to those for whom a fluoridation future is assured or it may possibly be of interest to those who have already been initiated into the fluoridation fraternity and who will derive some enjoyment from the fact that they are not alone in the cares and tribulations attached to the rearing of such a robust addition to such an old and respected family.

1. *Source of Fluoride:* One of the first decisions that had to be reached was that of deciding what would be the source of the fluoride ion used.

A survey of the field of chemicals available commercially and adaptable to industrial handling indicated the choice would have to be made between two dry-powder forms, (1) sodium fluoride (NaF), and (2) sodium silicofluoride (Na_2SiF_6), and hydrofluosilic acid (H_2SiF_6), all approved for application by the U. S. Public Health Service.

After receiving answers to questionnaires sent to twenty-four suppliers it appeared that hydrofluosilicic acid would be in short supply at the time receipt of shipments would begin. Shipment of the acid would have been in rubber-lined tank cars or in 100 pound rubber lined steel drums or barrels. The tank cars also were in short supply necessitating receiving the acid in the 100 pound drums. Handling the large number of drums of acid necessary to fluoridate an average water demand of 176 M.G.D. was prohibitive. In addition it was beyond the capacity of the manufacturers to supply Washington Aqueduct requirements in steel drums at that time.

Although hydrofluosilic acid was considered to be the simplest chemical to apply it was more expensive that sodium silicofluoride, particularly since the tonnage of the acid would be much greater than the silicofluoride on the basis of fluorine content. Another factor in favor of the use of a dry powder form was that available space lent itself more advantageously to the use of this form of product.

Choice between sodium fluoride and sodium silicofluoride was chiefly a matter of cost, the latter at the time of consideration being approximately 5½ cents per pound cheaper. In the quantities which would be used by the Washington Aqueduct (1¾ tons per day) this would be a considerable saving. It was recognized that sodium fluoride was the more soluble but it was felt that larger solution tanks could be designed to take care of this disadvantage and still effect a saving. From all indications sodium silicofluoride appeared to be the most reliable source as far as availability of supply was concerned, and in the final analysis the use of sodium silicofluoride was favored.

2. Location of Installation: Having adopted the source of the fluoride ion planning could then start for adapting commercially available equipment to the particular needs of the Washington Aqueduct installation. This in itself raised some questions. A glance at the location map of the water facilities (Fig. 1) shows two possibilities. A fluoride solution could be fed from separate installations, one at Dalecarlia where it could be introduced into the filtered water before leaving the plant and one at McMillan where it could also be carried to the clear well. A second possibility was placing two installations at Dalecarlia. One installation would feed to the Dalecarlia filtered water and the other would feed to the raw water supply going to McMillan. This supply line passes within approximately 300 feet of the Dalecarlia Plant.

One of the questions attached to the second possibility was: what would be the loss of fluoride in the passage of McMillan raw water through two large open sedimentation and storage reservoirs, a cross-town tunnel, and the slow sand filters of the McMillan Plant? The application of alum to the McMillan raw water supply at a point immediately below where the fluorine solution would be introduced would have a definite bearing on this loss. If there was a loss in fluoride, in what degree would it be and how would the cost of this loss compare with the cost of building and operating a separate installation at McMillan to avoid the depletion?

Past exerience by other pioneers in fluoridation indicated that there was little fluoride "demand" as such in reservoirs, pipe lines, basins, etc., so it was felt that loss through alum flocculation would be the greater part of any loss sustained. The Dalecarlia laboratory was called upon to estimate to what extent fluoride would be absorbed in alum flocculation.

There was not time for exhaustive research but sufficient data were gathered to indicate that at an average alum dosage of about 165 pounds per M.G. (1.16 gr/gal based on 17% Al_2O_3) only about 7 to 10% loss of fluoride would be experienced. At higher doses of 390 to 420 pounds per M.G. (2.74 to 2.93 gr/gal) as much as 25 to 30% of fluoride could be expected to be carried down with alum floc, but these high dosages were not of frequent occurrence. This information indicated the cheaper and more practical installation would be that under one roof at Dalecarlia for fluoridating both sources of water from that plant, certainly for a temporary installation and probably for a permanent one. It was recognized that certain monetary advantages would be gained by having this single installation under one roof and this would tend to offset the loss due to absorption on alum floc. In addition only one set of operators would be required. It was reasoned that if the loss of fluoride as actually experienced under operating conditions did prove to economically justify a separate installation at McMillan that steps could be taken in this direction when data from a full plant scale operation becomes available.

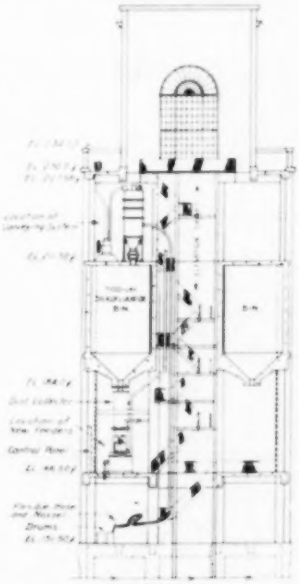


Fig. 2—Fluoride Installation. (Tower Section) at Dalecarlia Filtration Plant.

However, in the planning report the two plans were investigated and cost estimates submitted. The single installation plan, the cheaper of the two, was recommended with the reservation that separate installations might be economically justified later depending on experience under actual operating conditions.

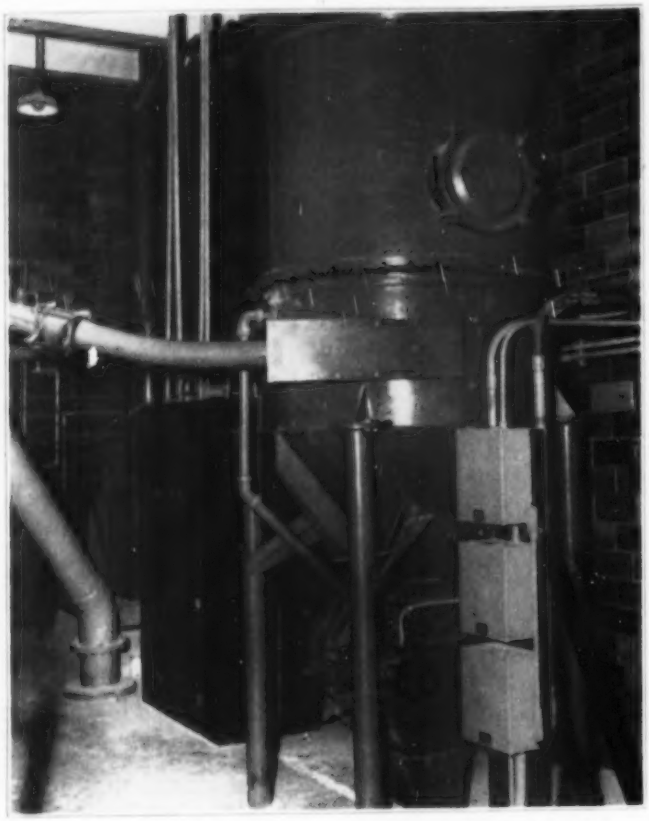
3. Adaptation of the Installation to the Existing Dalecarlia Plant: Having made the decision to use sodium silicofluoride as the fluoridating chemical, and having determined that the complete initial installation would be at the Dalecarlia Filter Plant, the next over-all problem was to plan fluoridation handling and feeding systems that could be adapted to the existing plant structure.

Plans of the existing structure were studied to ascertain the details of available space for the three main divisions of the system which would have to be tailored to fit the conditions. These divisions are: (1) the pneumatic conveying equipment; (2) the main feeding equipment, consisting of feeder hoppers, dry feeders and dissolving tanks; and (3) the piping layout to the Dalecarlia clear well and the McMillan raw water supply.

This equipment had to be planned around a large existing concrete bin from which the sodium silicofluoride would flow to the feeder hoppers supplying the dry-feed machines. It was necessary to design the pneumatic system not only to handle the sodium silicofluoride but also to fit into the space available over the storage bin.

The elevation available for the chutes, hoppers, feeders and tanks had to be so utilized that free flow of the material by gravity from the concrete bin to the feeding mechanism could be properly maintained. Structural framework had to be designed to support the hoppers and appurtenances and at the same time so planned as to make a proper connection with the existing structural conditions.

A piping system had to be planned which would be hydraulically sufficient and at the same time take advantage of the shortest and most advantageous route for conveying the solution through the building to the desired point of application. It had to be constructed from a material



RECEIVING STATION. Dracco Pneumatic Conveyor for handling silicofluoride.

which would withstand the corrosiveness of the fluoride solution.

Figure 2 illustrates the extent of the planning required. Where it became necessary to move existing machinery to accommodate fluoridation equipment, relocation plans had to be made and their execution integrated into the operational requirements of the plant.

All of these activities involved exchange of information with various manufacturers concerned in order to produce an installation which would be a working unit.

4. *Other Details for Investigation:* With the location of the installation resolved and with planning underway, other questions had to be investigated and answers found. Questions such as: In what quantity and packaging and how would the sodium silicofluoride be received? How would it be handled to bin storage? What protection should the men handling the material have to prevent contact with dust? Was the 45 degree slope of the bottom of the bin sufficient to prevent arching or should a 60 degree false bottom be placed and some air-operated bin flow device be installed to insure continued flow? What should be the size of the hoppers carrying material to the feeding mechanism? What type of feeding equipment was the best and what safety devices and machine antiflooding protection against overfeed would be needed? What were the most suitable means of eliminating the toxic dust hazard for personnel? What should be the sizes of the dissolving tanks for each of the two dry-feeders and of what material should they be made and with what should they be lined to withstand the 2 to 3 pH of a sodium silicofluoride solution? Should conventional rubber lined steel piping to the point of introduction to the water be used or should the new extruded plastic tubing, with its high corrosion-resistant and flexible handling qualities, be utilized? If plastic piping were used in what sizes was it available, what fittings could be obtained and what were its physical properties? Could it be used to transport materials intended for human consumption? Could it be fabricated and welded? In the case of the McMillan line should a new line be laid to feed the fluoride solution to the raw water or should an existing rubber-lined prechlorination feed line be utilized in the light of a possible move of the equipment to the McMillan Plant? If it were decided to use the chlorine solution line would feeding the chemicals together cause any unfavorable chemical reaction and would the hydraulics of the system permit it or would undesired back pressures develop? These and other somewhat lesser problems presented themselves at the planning stage. Indeed, after many of these were answered there still remained the problem of plans to be drawn and specifications to be written to insure that the answers to the above questions were incorporated in such a manner to obtain what was believed to be the best installation.

Before the planning report was finished much investigation had been done and, it was hoped, suitable answers would be found to most of these problems.

Some Solutions and Comments

Space does not permit a lengthy discussion of the answers to all of these questions but our experiences with the most pertinent ones may be of interest and, perhaps, of value to those contemplating fluoridation.

1. *Packaging:* Although there is a railroad siding available at the Dalecarlia Plant, shipment in bulk under Interstate Commerce Commission rulings was not fully clarified so the type of packaging available was either in 100 pound bags, 125 pound drums or 350-400 pound drums. Bag packaging was discarded because of the large amount of handling required in quantities needed by Washington's water demands, possibility of bag breakage in handling and the attendant toxic dust hazard, and because it was believed the method involved more troublesome problems in handling to storage.

Receipt in 125 pound drums would have again necessitated too much handling and warehouse storage. It was decided to purchase sodium silicofluoride in 350 pound drums in carload or trailer truck load quantities and unload to space available in the scale house of the main building.

2. *Conveying:* In the scale house the drums were to be opened and the chemical raised vertically by vacuum pneumatic equipment, which is no

more than an industralized vacuum cleaner, to a concrete storage bin of 125 ton capacity vacated for the purpose in the tower of the main building. This equipment would remove the finer dust particles through bag filters and would deliver the material into the storage bin. The fact that the nozzle of the pneumatic equipment would always be under vacuum when placed in the drum would greatly cut down the toxic dust hazard to the workmen. The sodium silicofluoride pneumatic receiving station is here pictured.

For further protection of the workmen, it was planned to supply them with cotton coveralls which could be laundered, rubber-impregnated fabric gloves, a suitable respirator with large breathing area, full view goggles which might be worn over glasses, and a cotton skull cap for head covering. The protective apparel worn by employees in handling sodium silicofluoride appears in an accompanying picture.

Up to this point in our experience the Dracco Pneumatic System procured has worked out just about as conceived in the planning report and has proved very satisfactory. There has developed no toxic dust hazard in conveying from the drum to the storage bin.

3. *Protection Against Arching in the Storage Bin:* Sodium silicofluoride is not considered to be hygroscopic but little was known of its arching properties. So, as a precaution, a 60-degree-slope, false wooden bottom and air slides placed in the bin was installed for the prevention of arching and to induce smooth flow of material to the feeder-hoppers.

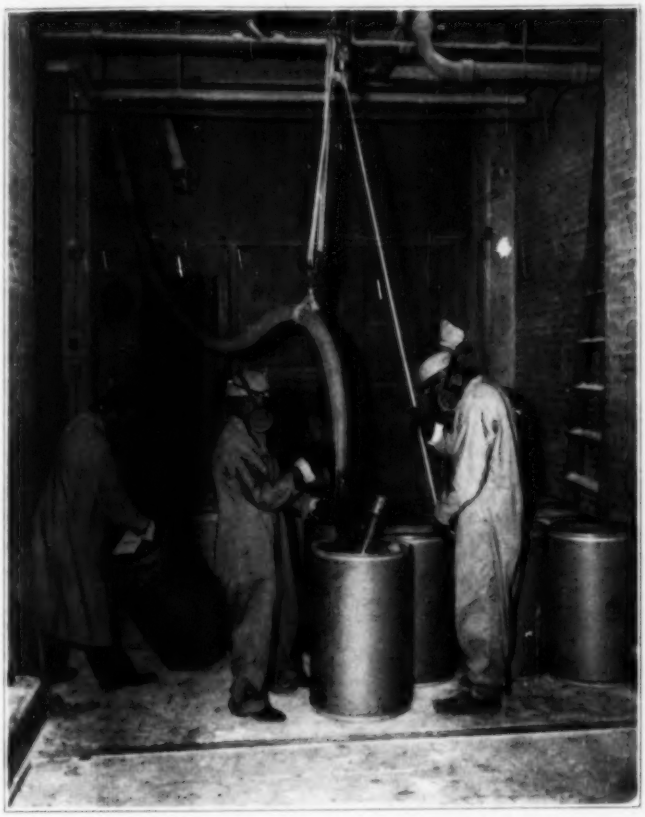
Until further information was known on the chemical caking properties under pressure of heavy loading it was decided that full advantage of the 125 ton capacity would not be taken but only about 20 to 30 tons maximum would be placed. So far this amount has not been exceeded but as of this writing, lumps are beginning to appear in the material causing difficulties in smooth application through the feeders. Moisture analyses do not point to hygroscopic action. It is possible that 20 to 30 tons may be too much weight and will cause compaction and subsequent lumping. The condition observed gives evidence of requiring more study and experience before the remedy is found.

4. *Feeder-Hoppers:* The sizing of the dry feed machine hoppers was determined on the basis of requiring that they each hold a day's supply of about 1 ton for both the Dalecarlia and McMillan feed. Experience thus far indicates a small capacity hopper would be preferable with the feeders being used. A smaller hopper would decrease flow-through time and thereby possibly aid in the prevention of lumping.

Some arching has occurred in the hoppers and short period vibrators have been placed to prevent a repetition of this occurrence. This arching has brought out the fact that hoppers with one vertical side would have been a more efficient installation than one whose four sides of the bottom slope at 60 degree angles.

5. *Dry-Feed Equipment:* After consultation with representatives and engineers of the leading dry-feed equipment manufacturers, it was determined a *gravimetric* type feeder would be the most desirable. Anti-flood gates were required to be placed between the hoppers and the feeder in order to prevent flooding and over-feeding. Dust collectors to prevent escape of dust to the surrounding air when the machine hoppers were being filled were specified, as well as dust proofing of the cabinet enclosure of the machine. An accuracy of feeding ½ to 1% had to be assured and sufficient alarms both visual and audible, for the over and under feeding, had to be furnished in order to insure the prescribed 1 ppm of fluoride. Indicators for the level, both upper and lower, of sodium silicofluoride in the hoppers were included in the feeding equipment. A rate of feed dial, graduated in millions of gallons per day on one scale and in pounds per day on an opposite scale, calibated to feed 14 pounds of sodium silicofluoride per million gallons for the entire range of the feeder, and an overall dust tightness, were basic requirements.

Wallace & Tiernan were the successful bidders with their Merchen Weigh-belt Feeder. The accuracy of the machine is satisfactory and with the exception of some adjustments on the dust collection system and refinements to be made on the dust-proofing of the housing of the equipment and



PROTECTIVE APPAREL worn by employees handling silicofluoride.

flexible connections, it appears that the equipment will answer the requirements. The two-weigh-belt feeders, solution tanks and electric control panel are shown in an accompanying picture.

6. Dissolving Tank Proportions and Lining: The solubility of sodium silicofluoride, as with most chemicals, varies with the temperature of the water. In the case of the plant feed water supply, temperatures vary from 40°F. to as high as 70°F. at times. Although the dosage of sodium silicofluoride to be fed was to be constant, at 14 lbs/mg the total amount to be fed would vary with the water demand.

In order to determine the volume needed, calculations were made for the detention time with tanks of varying volumes with assumed temperatures of dissolving water ranging from 34° to 80°F with the accompanying solubilities. Although a currently accepted figure called for *at least five minutes* detention time, a minimum of approximately fifteen (15) minutes was used in our case, since it was not planned to use heated water to aid solubility. Therefore, a sufficiently large tank would have to be provided to allow complete solution. In addition, aids to mixing such as jet agitators and flash mixers had to be included in planning the layout. For ease of fabrication and erection both tanks were made the same volume, 500 gallons each, although the Dalecarlia tank could have been less than the McMillan tank because of the smaller output. For an average water demand of 176 M.G.D. McMillan will supply 105 M.G.D. and Dalecarlia will supply 71 M.G.D. The size of the tanks therefor provide for overload at either filtration plant.

Both tanks, which have water jet action mixing devices with a flash-mixer as an auxiliary, appear to be giving complete solution. The volume of dissolving water is more than is required because of required adjustments to the water jets made in order to furnish sufficient jet action for proper stirring action. The real test of the performance of the tanks will come next winter when the temperature of the water falls to the minimum.

After consultation with manufacturers of tank linings, various chemical manufacturers, and having obtained information from those who had previous experience, it began to appear that natural rubber, synthetic rubber, plastic or cypress wood lining in the order named were preferred. Of the metals, brass and copper were considered only fair to handle this low pH sodium silicofluoride solution. Stainless steel was thought to be unsatisfactory. Hastelloy C and Duriment 20 were found to be very satisfactory but were expensive and in short supply. Natural rubber was also in short supply. It was recommended in the planning report that a lining of either Saran, Neoprene or Polythene be used on a structural steel tank and this was incorporated in the specifications. The lining furnished was polyethylene.

7. Piping: Some of the advantages of plastic tubing made of a basic compound called polyethylene had come to the attention of this office almost a year before planning the fluoridation installation. It had been successfully used for sample lines. It was flexible, corrosion-proof and had good properties for handling chemicals. Plastic tubing had a low bursting pressure (about 165 psi for a 3" size), but the planned line would only be under a slight pressure at the most. It looked as if plastic tubing might well do the job.

In the beginning the design of the solution line system was thought of as being made up of rigid pipe. However, at the time plastic piping could not be supplied in rigid lengths of the 3" size needed. Nor were fittings available in the varieties and sizes required.

Flexible plastic tubing would have served but there was a definite need for on-the-job fabrication for making connections, sharp bends, offsets, etc. It was then that information about welding of plastic tubing came to our attention. A demonstration by a factory representative was arranged. This paved the way for one of our employees to visit a Cleveland plant for further instruction.

The difficulties of handling the plastic piping installation were then cleared away. In the final lay-out it was decided to come from the solution tanks with rubber lined elbows for strength, thence with hard rubber pipe and fittings a short distance through the floor and from an advantageous point of connection cover the remaining distance with flexible plastic tubing. For more uniform distribution, rubber lined diffusers were used to terminate the solution lines at the point of fluoride solution injection into the water.

In order to avoid a plant shutdown an existing diffuser on a sulphur-dioxide line which could be spared is being utilized until next winter when it is planned to place a new fluoride solution diffuser in the filtered water passage.

8. McMillan Solution Line: It was evident that it would be more advantageous to use an existing 5" rubber lined steel pipe and diffuser, used for intermittent pre-chlorination of McMillan raw water, temporarily until it could be determined whether fluoridation of McMillan water at Dalecarlia would be economically justified.

The rubber lining was suitable for fluoride solution so there appeared to be no complication on this point. Since fluorine and chlorine are members of the same chemical group, the halogen family, there was no anticipated chemical reaction between the two. Laboratory tests were made for confirmation. The only remaining question was whether the hydraulics of the existing piping system might not permit back pressures on the chlorinators should both solutions have to be fed at once. The size of the line indicated this would not be a problem; further hydraulic analysis indicated that no trouble need be expected from this source. Accordingly, it was decided to use the line. Tests since fluoridation has begun have proved that the line performs hydraulically as was expected. Only future investigations will be able to determine the effects on rubber lined pipe for feeding both chlorine and fluorine solutions together.

Plans, Specifications and Installation

With the planning report as a basis, the installation had to be designed and plans prepared. Discussions and changes to take advantage of new information and material were perhaps more numerous than on the usual plant change or addition, because of the unusual character of this new treatment. Component parts of the pneumatic system and feeding equipment had to be so sized that they could be carried up the chemical tower to the place of installation by an existing elevator which was the only means of access.

Specifications were written and bids for the dry-chemical feeders and pneumatic conveying equipment were advertised in the fall of 1951. Installation plans and specifications for the balance of the equipment were finished by late spring 1952.

Erection of the pneumatic conveying system, which was the first equipment to arrive, and starting of the structural steel frame work for supporting the feeder hoppers were carried along together beginning in early April.

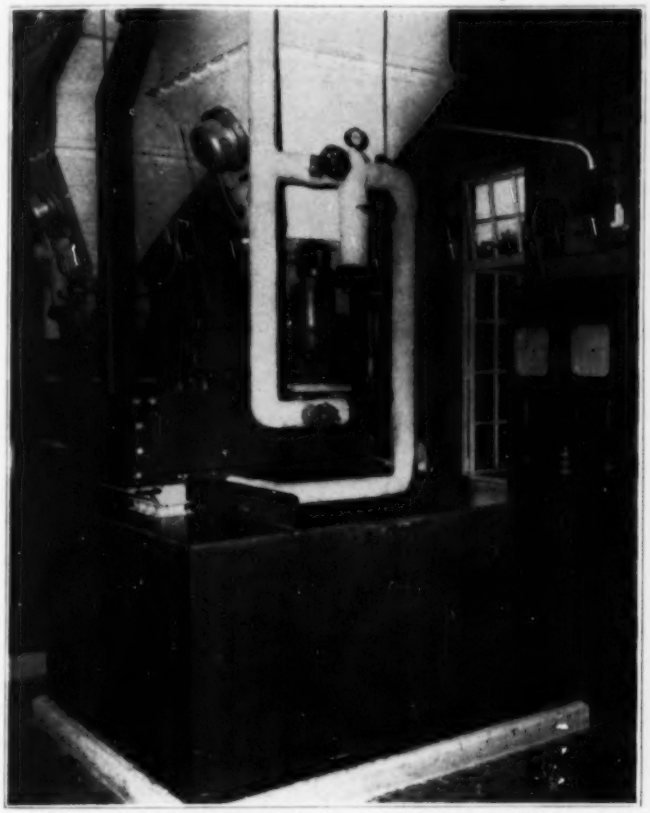
Some difficulty was experienced in delivery of materials and component parts, particularly in the order needed for erection.

When the dissolving tanks were in place and electrical tests run to determine if the lining was homogeneious and free of pin holes, it was found that patching would be necessary in a number of places. A factory representative was sent to the plant and made the repairs with the tanks in place.

In most phases the erection went smoothly with the manufacturers representatives actively cooperating to bring about a successful installation.

Tuning-Up and Operation

When the equipment was in place tests were started to determine the action of the feeders under actual operating conditions. The silicofluoride solution was run to waste while the tuning-up tests were being conducted. The calibration of the machines was checked to verify their accuracies. Thorough observation was given the operation of all safety devices, warning lights, controls and mechanical devices. When it appeared preliminary tests were satisfactory, the Board of Commissioners of the District were notified and the official starting date was set as 23 June at 9:30 a.m. The press was also notified of the starting time and a brief ceremony was held at which pictures were taken of the City officials throwing the switch to officially start the feeders.



FEEDERS of the weigh-belt gravimetric feed type, dissolving tanks and electric control panels.

Tracing Program

At a meeting of Washington Aqueduct, D. C. Water Department, and D. C. Health Department officials prior to the starting of fluoridation, a suggestion was offered by representatives of the Health Department that a tracing program be integrated with the starting of fluoridation in order to trace the progress of the chemical throughout the city. It was felt that it would be well worth the effort to gain whatever knowledge that would come of such a venture to add to information about the distribution system and the idea was well supported. The start of the fluoridation program afforded an excellent opportunity which is not often presented to use a trace chemical.

Plans were laid and all was in readiness at the start of fluoridation. Samples were taken every four hours from previously established sampling stations through twenty-four hours per day. Fire hydrants were selected as sampling points because of their accessibility throughout all hours of the day and night. The date and time the sample was taken was recorded on the sample and also in a record book, and brought back to the Dalecarlia Laboratory and analyzed by a rapid colormetric test devised by the U. S. Public Health Service for the particular needs of the program. A rapid quantitative test also developed by the U. S. Public Health Service was run by the laboratory which operated on a twenty-four hour basis. The tracing program was a joint effort of the D. C. Health Department, the Washington Aqueduct, the D.C. Water Division and the U. S. Public Health Service. Personnel of all services were utilized for approximately one week, and it was due to their willing cooperation and effort that the tracing program was a successful one.

Fluoride was a full week in reaching most outlying points of the city. It took nearly two weeks for all stations to show the full concentration of 1 ppm.

Although full analysis of the data of the tracing program has not been completed, enough of the data has been used thus far in operations of the water facilities to justify full well the planning and work necessary for the successful carrying out of the plan. A view taken within the Dalecarlia Laboratory, showing apparatus (a spectophotometer) used in the determination of fluoride, accompanies this article.

Operating Experiences

Experiences gained in the short span of fluoridation have presented problems lying chiefly with the chemical utilized and the feeding mechanisms, but a brief summary of each phase of activity will be presented.

1. *Receiving of Chemical from Supplier:* Sodium silicofluoride has thus far been received packaged in 350-lb. lever-pack fibre drums in carload lots. A few drums have been damaged in shipment but none to the

extent that the contents were not usable. Unloading the car has presented no problems, the drums being handled with the conventional roller conveyor or hand truck from car to warehouse storage or by hydraulic lift gate truck if being handled directly from the car to the scale house from drum unloading. The Dracco Pneumatic System operates well in handling the material vertically from the drum to bin storage, a distance of about 75 feet. There has been no dust hazard at any point in this system. Drums are emptied quite clean by use of the suction principle. It can readily be stated that vacuum pneumatic handling of sodium silicofluoride is easily accomplished provided the system is properly designed.

2. Sodium Silicofluoride and Bin Storage: At this writing the principal problem of our fluoride application is that of material behavior. The chemical as purchased meets all requirements with the exception of free-flowing characteristics.

It has been noticed that on emptying drums of sodium silicofluoride with the cylindrically shaped nozzle of the pneumatic conveying system a hole the diameter of the nozzle may be cut to the bottom of the drum leaving material standing surrounding the hole. This shows practically a 90° angle of repose and indicates its tendency to compact. Whether this is a condition resulting from continual vibration of railroad cars in shipment or due to storage in drums over a period of about 60 days or a combination of both these features before emptying is not known. The condition appears to be a progressive one. Difficulty with lumping was not experienced at the start of the fluoridation program but has assumed a position of increasing annoyance 60 days later.

These lumps cause an obstruction in the chamber feeding material to the belt of the gravametric feeding machine which is not remedied until an operator removes them by hand. This requires a large amount of personal attention which should not be necessary. In addition a check on the accuracy of the machine is impossible until a smooth flow is established.

The remedy is not known at the moment. The sizing of the material accepted was in keeping with what most manufacturers could furnish at the time and was somewhat coarser than originally specified. Moisture does not appear to be a problem. Recent tests indicate less than 0.05% moisture is present in sodium silicofluoride being fed to the solution tank and substantiates the claims that it is not a hygroscopic chemical.

It has been suspected that lumping may have been caused in the bottom of the bin storage by the weight of super-imposed material. There have been as much as 20 to 30 tons of material in storage at one time; however, the condition persisted even when the bin was very close to being empty. It would seem that the presence of moisture would have to be an adjunct of this condition if over-burden was to be the factor. This does not seem to be the case. One other supposition might be that the fines in the material are tending to hold the larger particles together under weight and thus causing cohesion. Continued effort will be made to find a remedy for this situation particularly in view of the necessity in the very near future for drawing up the specifications for the requirements of the coming year.

In conjunction with the material the bin storage in which the chemical is kept is offering some problems also. One of these principal problems is the failure of material to flow out of this bin at low levels even with a 60° sloping bottom and air operated bin flow devices. These devices assist material flow by using compressed air as the fluidizing agent to increase the flow properties of the material which are causing the difficulty although some of the flow devices may not have been placed low enough in the bin to create sufficient air agitation to promote free flowing. It may be that when the problem of free flowing material is solved it will be found that flow in the storage bin will be satisfactory.

3. Hopper Storage to Chemical Feeders: Arching of the silicofluoride in these hoppers has been experienced. It is believed that lumping of the material currently giving trouble in the feeders may also be occurring at this point. A periodic vibrator which has been placed on the bottom of this hopper does not seem to be remedying the situation.

Our original practice was to keep the hoppers fairly full at all times, filling them before the low level indicators show re-filling to be necessary. This practice was dropped and the hopper level is being allowed to reach its lowest level before re-filling in the hopes that old lumps may be fed out and less lumping will occur in a shorter detention time of the material in the hopper. At present this does not appear to be of much help.

4. Chemical Feeders: Minor adjustments to the Merchen Gravametric Feeders have been necessary over the period since the beginning of fluoridation to insure correct working order.

There have been no serious difficulties attributable to the feeders in maintaining steady application of fluoride. Most of the trouble has been associated with the dust collection system which has failed to function efficiently. The feeder housing, which has not been dust-tight, has allowed leakage of fluoride dust outside the housing and through flexible connections. However, these minor deficiencies are in the process of being remedied. A corrosion condition is developing on some metal surfaces in contact with the chemical which indictates a need to have these features receive attention in future designs.

5. Dissolving Tank, Effluent Piping System: Sufficient time has not elapsed to evaluate what the real service of the plastic tank lining and pipe will be. From visual observation the tank and piping system are functioning satisfactorily and there is no evidence of attack on the plastic linings or piping.

Samples collected and analyzed have shown that complete solution is obtained at the inlet to the clearwell at the Dalecarlia Plant which indicates the solution tanks are functioning properly. Obtaining complete solution of the fluoride feed in the McMillan raw water is no problem because of a larger amount of dilution water and longer course of travel before reaching the point of application.

Laboratory Control and Sampling

The Dalecarlia Laboratory maintains a constant supervision over the application of fluoride, the sampling program for plant control, the fluoride residual in the distribution systems, and the laboratory analysis of the samples and chemicals connected with the fluoridation program. A brief discussion of some of these controls follows:

1. *Application of Fluoride:* The fluoride residuals (F^-) in drinking water as recommended by the D. C. Health Department lies between 1.0 and 1.1 ppm for the maximum benefit in reducing dental cavities in children's teeth. In order to obtain this residual in the distribution system two factors had to be considered.

a. The amount of fluoride (F^-) present in the raw water.

b. The amount of fluoride (F^-) absorbed as a result of flocculation treatment.

Weekly analysis of samples of Potomac River water taken some four months prior to the start of fluoridation indicated the amount of natural

fluoride (F^-) varying from a trace to 0.15 ppm.

The main control of the feeders and application of the fluoride solution lies in hourly recordings of the amount of fluoride fed to a metered amount of water flowing through the plant. These figures are logged and furnish a ready indication of the performance of the feeding equipment. In addition, operators working a 3-shift per day schedule personally check during each shift to see that performance of the equipment is normal. Each day a weight check is scheduled in order to verify the accuracy of the feeders. It is believed, however, that a weekly weight check on the feeders is sufficient once it is verified that the equipment is operating accurately. The machine will feed reliably barring the presence of lumpy material or mechanical or electrical difficulty.

2. *Sampling:* After discussion with D. C. Health Department officials, the following sampling program was agreed upon to test the results of the fluoride application and to furnish further control. (1) Sampling for plant control and (2) sampling the distribution system to determine the final results of the fluoride application.

For plant control there are collected daily samples varying in amount from 500cc to 1000cc depending on the quantity needed. These samples are composited hourly and represent water conditions at four stages as marked by letters on the map—(Fig. 1).

a. Raw water entering the purification system (designated point "B").

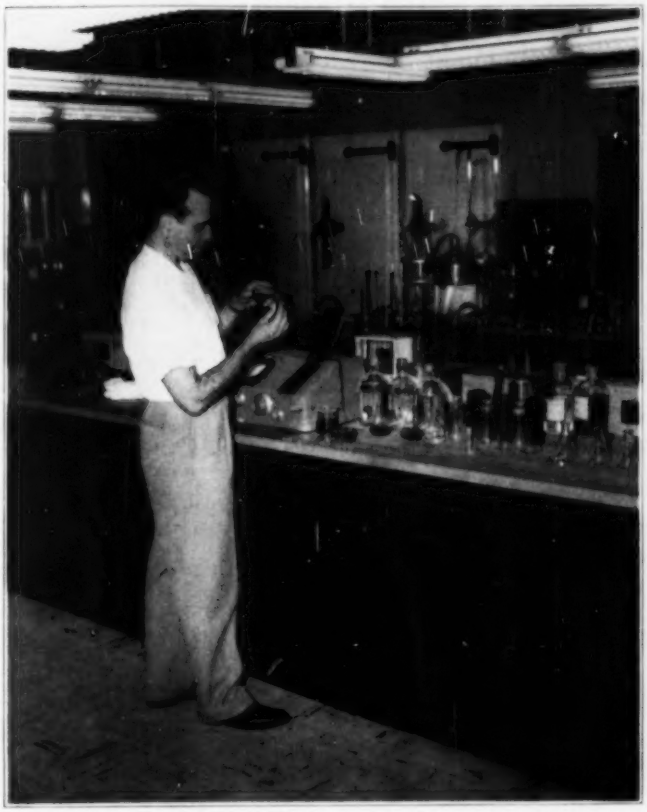
b. Finished water in the Dalecarlia Rapid Sand Filtration Plant (designated point "P").

c. Alum treated settled water from pump discharge to McMillan slow sand filters. Water at this point has had sedimentation in Georgetown Reservoir, passage through a cross-town tunnel, and further sedimentation in the McMillan Reservoir (designated point "F").

d. Finished water leaving the McMillan clearwell (designated point "J").

One composite sample from each of the above points is analyzed the morning of the following day by the Dalecarlia Laboratory. One half of samples "P", "F", and "J" are submitted to the D. C. Health Department for a check analysis.

By approval of the D. C. Health Department, samples are analyzed by the Dalecarlia Laboratory to 0.1 ppm of fluoride (F^-) by the Megregian-Maier* modification of Standard Methods procedure. A report on plant treatment results is submitted to the D. C. Health Department semi-monthly.



LABORATORY at Dalecarlia Filter Plant. Making rapid tests for fluoride content with a spectro-photometer employing Megregian-Maier method.

Regularly established bacteriological sampling points (principally tap samples) are also utilized for distribution system sampling for fluoride content. They are so chosen as to represent average conditions as well as the conditions at the extremity of the lines in each of the various pressure zones. Two spot samples (250 cc) are collected by Washington Aqueduct personnel on alternate days from each of five pressure zones, and from the Cities of Arlington and Falls Church. No samples are collected on Saturday or Sunday.

A report on the results found in the distribution system is included as a part of the report on plant control which as previously mentioned is forwarded semi-monthly.

The D. C. Health Department maintains a separate schedule on spot sampling and analysis at other points than those on the Washington Aqueduct schedule, but in like number and according to the same procedure of analysis. This procedure extends the coverage of points and furnishes a check on analytical methods.

Altogether 73 samples per week are scheduled for collection and analysis by the Washington Aqueduct. In addition samples are collected for information in the day to day operation of the new treatment.

Sufficient data has not yet been gathered to have complete information on all of the variations experienced in the fluoridation program. However, average figures for plant treatment and distribution system are given in Table I for the month of July 1952, the first full month of operation. At this writing the month of August is not complete but appears

*Magregian-Maier "Modified Zirconium-Alizarin Reagent for Determination of Fluoride in Water" JAWWA, Vol. 44, No. 3, March 1952, p. 239.

Table I

FLUORIDE OPERATIONAL DATA—JULY 1952

(All figures are in ppm. Fluoride ion F^-)

Natural F Potomac River Water	Dalecarlia Plant			McMillan Plant			Distribution System (73 Samples)
	Applied F to Filtered Water		Clearwell Dalecarlia Point "P"	Applied F to Raw Water		Clearwell McMillan Point "J"	
Min. Av. Max.	Min. Av. Max.		Min. Av. Max.	Min. Av. Max.		Min. Av. Max.	Min. Av. Max.
0.06 0.10 0.22	0.91 0.95 1.04		1.07 1.10 1.32	— — —		— — —	
0.06 0.10 0.22	— — —		— — —	0.81 0.99 1.15		0.68 0.97 1.18	0.60 0.99 1.14

to be following the same general pattern.

Table II shows a developing trend toward loss of fluoride due to absorption on alum floc. There is definite indication that as turbidities rise and alum dosage is increased the loss of fluoride increases. The manner in which this variation occurs is not presently known nor has any correlation with time or rate of flow been established. Much more data will have to be gathered and study made of it before a reliable pattern can be developed. Table II also gives approximate values of these losses based on the limited data at hand.

In Summary

In recounting our experiences which are those of a large plant in an area with an average water demand of 176 mgd (243 mgd, max demand) the idea has been to present material that may be of value to those who will soon face problems of fluoridation or who are currently dealing with situations arising in daily operation.

From experiences at the Washington installation the following observation can be made:

1. Receipt of sodium silicofluoride in drums by carload shipment is satisfactory and for a large installation considered to be more satisfactory than paper bags. This plant will consider shipments in carload lots when and if such become available, provided the problem of lumping by weight compaction is solved. Handling from the car to storage would be by means of a vacuum pneumatic system.

2. Vacuum pneumatic handling of sodium silicofluoride is highly satisfactory provided properly-designed equipment is obtained. Dust in handling ceases to be a hazard if the equipment is properly installed and maintained. This, however, does not obviate precautions of providing personnel with respirators, goggles, and other necessary protective clothing.

3. Obtaining sodium silicofluoride which does not agglomerate to form lumps after storage in bins or hoppers is a problem at this writing. The material of our experience does not remain free-flowing after 30 to 60 days' storage and tends to cake and solidify under bin storage, causing a lumpy material to reach the feeders. It is difficult for the feeders to handle this material necessitating constant watching and requiring too large a proportion of the operator's time. Currently this is the most pressing problem to which a solution has not yet been found.

4. Should bins or hoppers with sloping bottoms be used, the minimum recommended angle for gravity flow of material is 60° with the horizontal. Even with this angle this plant has experienced some difficulty in obtaining flow of material when the level is such that the sloping bottom only is full. In this case flow of the material had to be aided by manual effort. A more desirable installation will be obtained and better gravity flow gained if bins and hoppers have one vertical side, or so it is believed.

5. Where flexibility of erection is obtained by the use of flexible connections of canvas, it is believed a more dust-tight installation can be obtained if a rubberized fabric is used in place of canvas and if more attention is given to the design of means of attachment.

6. Corrosion of metal parts of the feeder mechanism in direct contact with silicofluoride, and inside the feeder housing, has been noted in the short time since 23 June 1952 when the program started. It is believed that instead of standard stock materials substances especially adapted to this and other corrosive chemicals would be more desirable.

7. In cases where the fluoride solution is introduced to filtered water, precautions should be taken to prevent the passage or introduction of any foreign materials through the fluoridation system to the filtered water by use of screening or other suitable means. Constant supervision by responsible personnel is required here as in any other method of water treatment.

Table II

LOSS OF FLUORIDE DUE TO ABSORPTION ON ALUM FLOC

(Artificially Applied Fluorides)

Alum Dosage Gr/Gal.	Approx. Avg. Fluoride Loss Percent
1.1	5.0
1.5	10.0
2.0	20.0
2.5	30.0

Note: This tabulation is based on the assumption that all loss that occurs is due to absorption on alum floc.

8. The use of hard rubber pipe where rigidity is required and plastic pipe of a polyethylene base, where flexibility and non-corrosive qualities are important, has some points of advantage over the customary rubber-lined steel pipe in that it lends itself to an easier and more rapid installation—especially if plastic pipe welding is utilized on the job. It would be assumed of course that the characteristics of the plastic pipe lent themselves to the particular requirements of the job.

9. Although not proved conclusively, there appears to be a definite absorption of fluoride by alum flocculation which increases with the increase of alum dosage. At medium dosages of 1.1 gr/gal. the loss due to absorption is approximately 5% and on high alum dosages of 2.5 gr/gal. the loss may be as high as 30%. Continued study of this absorption will be needed for accurate compensation for this loss by adjusting the fluoride dosage. Meanwhile there may be occasional deficiencies of fluoride residual on high alum treatment.

10. Loss due to absorption in reservoirs and the distribution system seems to be inconsequential. Certainly at this time it does not appear to be large enough to necessitate an increase in fluoride addition to compensate for it.

11. Handling of silicofluoride is not an occupational hazard if every effort is made to handle it in a dust-tight closed system and adequate protecting clothing and equipment are provided when there is any exposure to the dust.

12. Equipment to feed fluorides is available and adequate to meet and maintain the dosage requirements of public health agencies. With proper equipment and alert and competent supervision, the chances of over dosages even in small amounts is indeed small—the probability of a few scattered over dosages that would cause harmful effects are practically nonexistent.

P.S.—It is hoped that in this presentation will be found helpful information for those who have or may have a part or general interest in a fluoridation program. Time, experience and results will write the final story of the future of fluoridation.

"This I Believe"

Thoughts of One Water Works Man.

by VAN HORN ELY, JR., *Vice President,*
The Phila. Suburban Water Co., Bryn Mawr, Pa.

Imagine our surprise when the Ed. Murrow program—"This I Believe"—on the C.B.S. network came in through the writer's desk receiving set on the evening of September 12th, to hear Mr. Murrow say—

"We will now hear a prominent Philadelphian of a Quaker family, and a successful water utility executive, recount his beliefs—Van Horn Ely, Vice President of the Philadelphia Suburban Water Co."

After hearing Mr. Ely's "beliefs" we immediately wrote him requesting a copy of his "This I Believe" script and permission to print it in *Water & Sewage Works.*

Both were forthcoming and it is a privilege to pass along these "Thoughts of one water works man" to those who did not hear this radio program. It is one of a series of "This I Believe" C.B.S. broadcasts by prominent men.—L.H.E.

THE greatest source of unending pleasure is all around me in the shape of my fellow human beings. Everything I do is the result of some form of contact or activity with others like myself.

I believe that the way to get the most happiness out of my everyday life is to approach others with the belief that they are happy individuals who welcome their contact with me, and who sincerely want to be pleasant and honest with me. I believe that the natural impulse of most individuals is one of fellowship and kindred spirit.

I have found that the more conscious I am of this kindred spirit between men, the more readily I plunge into the mainstream of life. The knowledge and inspiration that I have gained by feeling this way have had a far-reaching effect on my life.

* * *

More than three thousand years ago, one man who possessed a deep reverence for God and his fellow men, devoted his life to bringing peace and order to his people. He realized that to have law and order among them, he would need some plan or code as a basis.

In his humility, this man, a young Hebrew called Moses, appealed to the Almighty for assistance. God rewarded his trust and gave him the Ten Commandments on two tablets of stone. These have been the guide for millions of people down through the ages to keep each and every one reminded of his obligation to his fellow man and to his Creator.

I believe that deep down in every one is a veiled realization that he is a child of God—and that whether or not he has subscribed to the Ten Commandments and their great philosophy, he unconsciously feels the need for their guided principles—self-respect, self-improvement, self-reliance and self-discipline. He unconsciously realizes, I believe, that "Thou shalt love thy neighbor as thyself." And although this often runs counter to his own selfish interests, he has learned by many a sad lesson that men enjoy the peace given here on earth in much the same measure as they show interest in the well being of others.

Man is born of a group. Without group living, his survival would be difficult indeed, with few, if any, opportunities to develop his talents and strive for the pursuit of hapiness.

* * *

I believe that I, personally, can do much to shape the future for myself and those around me. It is a breath-taking challenge. In a very real sense I can help stabilize the world. For everything is in the terms of the individual in units—the family, the community, the country, the world. And, as America goes during the next five or ten years, so probably will go the World.

Down through the centuries human nature has not changed. The same shortcomings of a thousand or more years ago are present today. But also is present the instinctive liking of one individual for another.

* * *

And so; I believe that if I approach my problems and my dealings with others—whether they be business or social contacts—with an open mind and heart, I will have a life rich with understanding of others and be tenfold repaid with the trust and love of my fellow men.

Waterworks Management Short Course at Illinois

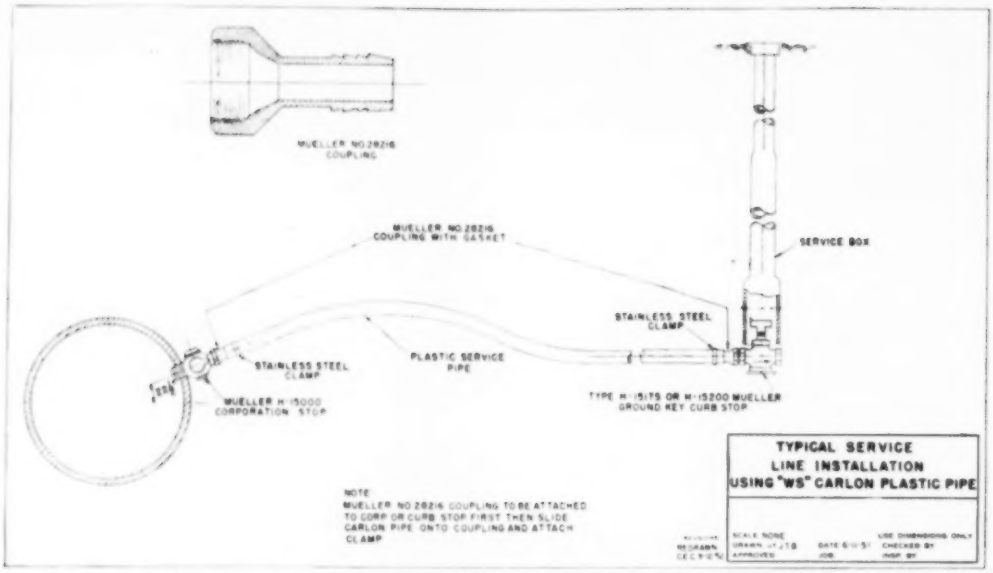
The inservice training committee of the Illinois Section AWWA is sponsoring an unusual short course in waterworks management. The course will be conducted by the business management service of the University of Illinois College of Commerce and Business Administration, with registration limited to 40. The three-day session, Nov. 19-21, will be held at Allerton House, Champaign, Ill., where complete facilities are provided for learning, relaxation, lodging and meals.

"Management Problems Today" will be the lead-off topic, with Louis R. Howson, of Alvord, Burdick, and Howson, as the first speaker. Among other important subjects to be presented by outstanding waterworks men are:

"Cost Control—Building Revenue" by W. Victor Weir, President, St. Louis County Water Co. and Missouri Water Co.

"Panel Discussion on Public Relations" by John E. Kleinhenz, Publicity Director, Indianapolis Water Co.; and A. P. Kuranz, Manager, Waukesha Water Utility.

The course is designed for executives in the waterworks industry in Illinois, to provide professional training in current techniques.


MUELLER NO.28216 COUPLING
MUELLER NO.28216 COUPLING WITH GASKET
SERVICE BOX
STAINLESS STEEL CLAMP
PLASTIC SERVICE PIPE
STAINLESS STEEL CLAMP
MUELLER H-15000 CORPORATION STOP
TYPE H-15175 OR H-15200 MUELLER GROUND KEY CURB STOP
NOTE
MUELLER NO.28216 COUPLING TO BE ATTACHED TO CORP OR CURB STOP FIRST THEN SLIDE CARLON PIPE ONTO COUPLING AND ATTACH CLAMP
TYPICAL SERVICE LINE INSTALLATION USING "WS" CARLON PLASTIC PIPE

SERVICE LINE installation with flexible plastic tubing, showing connections with bronze couplings and stainless steel clamps.

James G. Carns, Jr.

Experience With Plastic Tubing for Water Service Installations

by

J. G. CARNS, JR., *Equipment Engr., and*
M. E. FLENTJE, *Research Engr.*
American Water Works Service Co., Inc.
PHILADELPHIA, PA.

Martin E. Flentje

THE American Water Works Company, Inc., is a public utility holding company owning and operating 111 water companies in twenty-two states from Maine to Alabama and from Massachusetts to Kansas. It maintains a service organization, American Water Works Service Company, which provides specialized technical services (management, financing, legal, engineering, etc.) to the operating companies.

In accordance with our company's policy to conduct research and obtain data on new products and procedures, a decision was made in the early part of 1951 to look into the use of plastic tubing and pipe as service installation material. Three other major factors influenced this decision and the subsequent procedures which have been followed. These were:

(1) the difficulties experienced in obtaining copper tubing in sufficient quantities to insure our ability to make service connections to serve all new consumers requesting service;

(2) the unsatisfactory experience with substitute materials used during World War II when the use of copper tubing for water services was prohibited;

(3) the economics of the situation. The cost of copper tubing, like many other items, has almost tripled since 1940. With the prospects of other periods of scarcity, either of temporary or prolonged duration, the price of copper tubing may be expected to remain at its present high level or go even higher. With the newly developed plastic tubing and pipe being comparable or lower in price now; with ample supplies of ingredients and the ease of its manufacture, we look for a marked price spread between copper and plastic tubing in the future.

Our Experience With Plastic Tubing

Our experience with several thousand feet of plastic pipe may be of value to others in the water works field. The following is therefore presented as a factual case history of our experiences to date.

When the term plastic is mentioned, a multitude of products and materials comes to mind. These compounds all have molecules of large size, beyond that not many generalizations can be made. In this investigation two classes of plastic materials were considered—polyethylene plastics and vinylidene chloride. These compounds are chemically inert, resistant to most chemicals, light in weight and when made into flexible pipe, are easily installed. In addition these materials are tough and have good resistance to water. Pipe or tubing of the second type is in very common use in industry, but was not generally available in the sizes needed for water works use.

Polyethylene Tubing Seemed Most Practical

The type of pipe manufactured of polyethylene plastic seemed most practical for service work. It has the

advantages of being flexible, light in weight and is claimed to be immune from deterioration in the ground. In comparison with copper, plastic pipe is not as strong structurally, will not withstand high temperatures and is weak if the regular molded plastic connection is used. We purchased initially for experimental installations at 15 companies 36,000′ of ¾″ and 1″ polyethylene pipe having I.D. of 0.824″ and 1.070″, with wall thicknesses of 0.113″ and 0.120″ respectively. Installations of this material were made at locations where the pressure did not exceed 100 pounds per square inch. Instructions were also issued that, wherever possible, these services were to be installed in unpaved streets. This procedure, of course, was designed to reduce replacement cost if the tubing did not prove satisfactory. Original installations of this material involved the use of molded plastic adapter couplings and stainless steel clamps.

Troubles Experienced

Shortly after some services were installed, two distinct types of failure were experienced. Although the number of failures was not large in a numerical sense, they were considered to be excessive percentagewise and no further installations were made pending a complete review of the situation. The failures noted were:

(1) Breakage of the plastic adapter nipple at a shoulder, presumably from earth settlement and compaction caused when vehicles crossed the trench;

(2) Longitudinal splits in the pipe, which occurred adjacent the clamp holding the plastic adapter nipples. These splits ranged in length from ½″ to 3″. Although we have not been able to determine the cause of this type of failure, it is believed that it was caused by the serrations of the plastic nipple having too large a diameter which stretched the pipe, thereby weakening it sufficiently to cause it to rupture under pressure.

Correctives

After consultation with the manufacturer the unused quantities of this pipe were returned and arrangements made to obtain pipe with a 50% thicker wall of 0.173″ and 0.181″ in ¾″ and 1″ sizes respectively. It was also decided to use a metal adapter nipple in place of the rigid molded plastic adapters. Although nipples made of ¾″ and 1″ copper tubing 8″ in length proved satisfactory a manufactured bronze adapter nippde, as shown in the accompanying sketch of typical plastic service installations, was finally adopted for regular use. It should be noted that in all of these experiments standard corporation and curb stops for copper have been used so that if replacement becomes necessary, this work will be at a minimum.

Initial installations of the heavier wall plastic tubing services with bronze adapter nipples corrected the two types of failure previously noted. The scope of our experiment was then extended to include all 111 of our operating companies by the purchase of a sizeable, additional quantity of plastic pipe. To June 30th, 1952, over 850 ¾″ and 1″ plastic services have been installed. No particular installation difficulties have been experienced and with reasonable attention to the fact that plastic pipe is readily damaged by sharp stones, shovels, etc., satisfactory service installations may be made. No complaints of taste and odor of water from these installations have been received. All installations have been made with regard to the limitations which we have imposed on the pressure to which this pipe should be exposed—namely pressures below 100 p.s.i.

Question of Toxicity

The question of the *possible* toxicity of plastic pipe has arisen several times. While there has been no laboratory demonstration that these pipes are completely non-toxic the manufacturers point to the use without trouble of many feet of their "suitable for food-use" material in the food-processing industries. After discussing this with the manufacturer of the tubing which we use we came to the conclusion that this problem had been thoroughly considered and that we could depend upon the statement of the manufacturer that the "water supply type" of pipe is safe to use. The question of toxicity has not been raised by public health agencies.

Time alone, of course, will tell whether plastic services will prove to be satisfactory over long periods, such as has become expected and is an actuality with copper tubing.

Concrete Pipe Assn. Announces 2nd Annual Short School

To Hear McGauhey and Rowe on Sewer and Culvert Construction

The American Concrete Pipe Assn. will conduct its 2nd Annual Short School of Instruction for representatives of member companies on Nov. 20, 21 and 22 at the Sherman Hotel, Chicago, Ill.

On the afternoon of the 20th Ivy H. Smith, A.C.P.A. president, will introduce Prof. P. H. McGauhey of the Univ. of California who will talk on "Concrete Pipe in Sewer Construction" and R. Robinson Rowe of the California Dept. of Highways, who will discuss "Concrete Pipe in Culvert Construction."

A panel discussion on "Manufacturing Problems" in the production of concrete pipe, and classes in "Concrete Pipe Promotion" and "Selling Concrete Pipe" will be featured on the 21st and 22nd.

Howard F. Peckworth, Managing Director of the Assn., will lead a discussion on ASTM Specifications. The school is being conducted under direction of J. G. Hendrickson, Research Engr. of A.C.P.A.

Lloyd Billings Is Dead

Lloyd C. Billings, Supervisor and Chief Chemist of the Dallas, Texas, Water Works died on September 9th at the age of 65. He had been chemist in charge of Dallas water treatment plants since 1930.

Mr. Billings was recognized by the water works profession as one of its outstanding technical men. A member of the A.W.W.A. since 1923, he was the recipient only last May of the Association's Fuller Award. He was also a member of the F.S. & I.W.A., and the American Chemical Society.

Mr. Billings served as Editor of the highly regarded Texas Manual for Water Works Operators, and as co-editor of the Texas Manual for Sewage Works Operators. His son Clayton H. Billings is Senior Engineer with the Texas State Dept. of Health.

"With the rapid centralization of power in the hands of a few . . . unless the American people stem this threatening tide, human liberty will inevitably perish from our land."—*Gen. Douglas McArthur.*

Groton's Hotel Griswold

New England Water Works Assn. Holds 71st Annual Convention

Presidents

Outgoing	Incoming
Fred C. Almquist *Sanitary Engineer* *State Dept. Health* *Hartford, Conn.*	*Stanley M. Dore* *Deputy Chief Engr.* *Water Supply Bd.* *New York City*

THE N.E.W.W.A. held its 71st Annual Convention on September 8-10 at the Hotel Griswold, Groton, Conn., with a registration of 560 members and guests. All technical sessions, exhibits of water and sewage manufacturers, and social events were located in the hotel which overlooks Long Island Sound.

One afternoon was devoted to a trip, for both men and women, to the U.S. Submarine Base at Groton. This provided an exceptional opportunity to inspect some of the buildings at the base and to examine the interior workings of a modern submarine.

The social program included a dance jamboree on the first evening. The excellent floor show on the second evening and the banquet on the last evening were contributions of the Water and Sewage Works Manufacturers Association. There was a golf competition and a softball game for the men, with bridge and a bus trip to historic Mystic Museum for the ladies. An aquatic show at the hotel pool and a social hour on the lawn patio preceded the banquet on the final evening.

Honors & Awards

At the Wednesday Banquet the following honors and awards were bestowed.

On a distinguished visitor and program participant, Honorary Membership was conferred for the first time, we believe, to anyone from abroad. The Honorable HENRY F. CRONIN, Chief Engr. of the Metropolitan Water Board, London, Eng., who had presented a well prepared paper on "The Water Supply of London, Eng." earlier, was the recipient of the only Honorary Membership bestowed in 1952. Mr. Cronin went through all of the bombings of London in World War II; has the distinction of being a past-president of the Institution of Water Engineers of Great Britain, and presently is the president-elect of the British Institute of Civil Engineers. He responded in the fashion which an erudite British gentleman can respond and was warmly applauded. With him at head table was Mrs. Cronin.

Honored Guest

Henry F. Cronin
Chief Engineer
Metro. Water Board
London, Eng.
(Honorary Member)

Medalist

Arthur D. Weston
Honorary Member
Consulting Engr.
Edgartown, Mass.
(Brackett Medal)

Vice-Presidents

Senior	Junior
Wm. B. Duffy *Superintendent* *Dept. Public Wks.* *North Andover, Mass.*	*Roger G. Oakman* *Superintendent* *Water & Sewage* *Needham, Mass.*

The Dexter Brackett Medal was awarded ARTHUR D. WESTON, former Chief Engr. of the Mass. Dept. of Health, past-president of the Association and Honorary Member. The award was made for his paper "Are We Overdoing or Underdoing Watershed Protection?" published in the N.E.W.W.A. Journal.

The Commemorative Award, this year in honor and memory of Robert Spurr Weston, a pioneering chemist in the water supply and sewage field, went to another chemist, I. LAIRD NEWELL, Chemical Engr. with The Henry Souther Engineering Co., of Hartford, Conn. The award was made for his paper—"The Corrosion of Household Water Storage Tanks"—which was published in the N.E.W.W.A. Journal.

Only one 25 year Service Certificate was presented this year. The recipient, SIDNEY S. ANTHONY, has served the Augusta, Me. Water District as its superintendent for more than 25 years. Mr. Anthony is a past president of the Association and has long been a main-spring and prime

Convention Scenes: Center and front "Prexy" Almquist, the "First Lady" and "Fred" Jr.

Program Chmn.

Fred E. Smith
Chief Chemist
Water Dept.
Cambridge, Mass.

Awardee

I. Laird Newell
Chemical Engr.
H. Souther Engrs.
Hartford, Conn.

mover in the Maine Water Utilities Ass'n.

New Officers

President Almquist read the results of the election of officers as reported by the Tellers.

President
Stanley M. Dore,
Deputy Chief Engr.
Board of Water Supply
New York City

1st Vice-President
William B. Duffy
Supt. of Public Works
North Andover, Mass.

2nd Vice-President
Roger G. Oakman
Supt. Water and Sewerage
Needham, Mass.

Secretary
Joseph C. Knox, Exec. Secy.
New England Pollution Control
Comm., Boston

Treasurer
William P. Melley
Commissioner of Water
Milton, Mass.

New Director
Edward L. Tracy
Director of Sanitary Eng.
State Dept. of Health, Burlington, Vt.

(Carry-over Directors are Allan F. McAlary, Rockland, Me., and Scott Keith, Boston.)

The Retiring President's Address

In his brief to-the-point report to the Association on progress, aims and objectives of the Executive Committee and accomplishments of the year, President Almquist reported a new high in membership at 1050. He commented on the aims of getting more programs to benefit the smaller Water Works Supt. and of the attainments in this direction during the year. The most important development of the year had been the appointment of a special Committee on Publicity and Public Relations and the appropriation of funds to be used in the effort to favorably publicize water service and to advance the status of the water works career man. In a sense the effort was to be directed to advertising the meaning and true value of public water supply service to the community.

Dancing in the Moonlight

The convention came to a pleasant close with post-banquet dancing in the moonlight in the patio at the end of the swimming pool, to the strains of distant music and to the accompaniment of the swish of swimmers in the pool.

Secretary

Joseph C. Knox
Secretary
N.E. Pol. Control Com.
Boston, Mass.

Treasurer

Wm. P. Melley
Commissioner
Water Supply
Milton, Mass.

Business Session

President Almquist opened the convention with a business session devoted to reports of officers and committees.

Secretary Knox announced that membership in the Association now stands at 1,042. Increased dues may be required in the near future, Treasurer Melley reported, as the estimated operating costs for the coming year will exceed the income contemplated. Committee functions were described in a report of the Committee on Committees, and several comprehensive reviews of individual committee's accomplishments were presented.

Entertainment Chairman
Gen'l. Comm.

John S. O'Reilly
Hersey Meter Co.
Boston, Mass.

Ladies Comm.

Mrs. Tom Lawrence
(Just a Super's Wife)
Groton, Mass.

Prof. C. N. Sawyer, Chairman, Committee on Water Quality and Treatment, discussed the need for N.E.W.W.A. to develop a positive statement of policy regarding water fluoridation. Such a statement has been advocated by a considerable number of the Association's members, has been outlined by this committee, and has been unanimously recommended for action to the Executive Committee. Prof. Sawyer decried the fact that lay members of a community may dictate practice while technical people take no stand. Strong pro and con discussion developed in the meeting, but the Executive Committee of the Association took no action regarding a statement of policy on water fluoridation.

Technical Program

"Progress in Solving Supply and Distribution Problems at Newton, Mass.," by Mark F. Croker, Commissioner, Water Dept., Newton, Mass.

Newton, the fourth largest city in the state covers 18 sq. mi. which includes 280 miles of streets for a population of 85 thousand. The sprawling nature of this residential (96.7%) community presents a number of water distribution problems. Mr. Croker described the city's program of adding new belt-line mains and restoring the carrying capacity of old mains. In addition, dead ends on the system are being eliminated and new well supplies are under development.

In and About The Griswold, Groton, Conn.

Here and there: center and front, the "Tom" Lawrences from another Groton—Mass.

The Newton water requirements may be augmented by drawing from the Metropolitan Water District Commission supply by means of two 5 mgd pumps (Newton is a charter member of the Commission). Plans have been made for a water supply and distribution system to serve for the next 30 years. Hydraulic studies are underway looking toward providing the entire supply from the District system. New engineering projects include an automatic pumping station; a new 30 in. main; additional elevated storage and a booster pumping station.

Water consumption reached a maximum of 12.6 mgd in July 1952. Final connections of the Metropolitan Water District Commission's lines may be completed in 1952. At that time, comprehensive new surveys will be undertaken to insure a system capable of meeting all demands.

Water Supply Insurance

"The North Fork Dam of the City of Asheville, N.C., Water Supply," by Truman H. Safford, Chas. T. Main, Inc., Charlotte, N.C.

Mr. Safford described the problems involved in providing and insuring a safe yield of clear water for the city of Asheville. The city is located in the Tennessee Valley at an elevation of over 21,000 ft. Maps were shown to illustrate the early developments in the supply—a city owned watershed and reservoir storage. By 1946-47, water consumption exceeded the safe yield.

A 1949 report on the needs for a new supply was prepared by the author's firm. Growth rates were determined; the city is relatively small in area, but the supply also serves 6 water districts and 2 small nearby cities (growth of population in the districts is greater than in the cities). Asheville requirements average about 122 gal. per capita per day, the present safe yield being a little less than the use of 11 mgd. By 1975, a usage of 18 mgd is contemplated.

An earth core dam (described by means of lantern slides) is under construction. It will enable the collection of water from a 22 sq. mi. watershed and will provide a reservoir capacity of 2.5 billion gal. Particular interest was shown in the use of sheet steel piling as a cut off against under flow through the dam.

Chemical Feed Equipment

"Guides for the Selection of Chemical Feeders," by P. A. Coffman, Jr., Chief Engineer, Omega Machine Company, Providence, R.I.

Standard equipment can be purchased to fulfill practically all needs for chemical feeding devices. Mr. Coffman presented and illustrated a very useful guide to proper selection of feeders, based on eight requirements. In brief these are:

W. & S.W.M.A. Brass

President	Manager
Everett M. Jones V.P. & Gen. Mgr. Simplex Valve & M. Philadelphia, Pa.	*John G. Stewart Water & Sewage Wks. Mfrs. Assn. New York, N.Y.*

1. Carefully define requirements.
2. Determine storage capacity needed.
3. Select the best location.
4. Select the type of installation best suited.
5. Select the type of feeding equipment.
6. List the accessories required.
7. Provide full information for feeder manufacturers.
8. Evaluate proposals.

Mr. Coffman noted in detail the items of importance involved in these basic requirements. His paper will serve as a guide to insure suitable and satisfactory chemical feeder installations.

Panel Discussion

An entire morning session was devoted to a Superintendents' Round Table panel discussion relating to the fluoridation of public water supplies.

In Water or Milk?

"The Optimum Vehicle for Fluoridation—Water or Milk," by Jack E. McKee, California Institute of Technology, Pasadena, Calif.

Mr. Knox read the paper prepared by Mr. McKee. The author cited the growing acceptance of water fluoridation, and described and documented the merit of the practice. As disadvantages, he cited the cost of equipment (with particular reference to communities which require multiple installation), and the cost of operation. The "limited" supply of fluoride salts which would lead to "shortages" and "increased costs" with the wider adoption of the treatment were noted by the author.

He also considered the treatment of value only to children (accounting for 0.04 per cent of the applied flouride); listed objections of religious groups; and reviewed the irregularities of water consumption (not uniform for all children).

The advantages of fluoridation, he suggested, might be obtained without the disadvantages of using milk as the vehicle. Certain questions must be investigated to determine the suitability of milk carried fluoride assimilation from this source; variability of consumption; effect on palatability and nutritive value; and public acceptance.

Mr. McKee stated that in Los Angeles County over 500 municipal and private water utilities supply domestic consumers—but that there are only 70 major milk distributors. The cost of milk fluoridation would range, he estimated, from zero to one cent per quart. He urged that research be devoted to the possibility of using milk for the vehicle.

Discussion

Dr. F. E. Law, Regional Dental Consultant, U. S. P. H. S., Boston, Mass., in a prepared discussion provided the answers to many questions raised in Mr. McKee's paper, noting that many of the same objections had been raised years ago with reference to the chlorination of water supplies. The relative number of water and milk suppliers in one area is certainly not generally like the example cited by Mr. McKee.

Dr. Law emphasized also that the chemical supply is adequate; adults are benefited by fluoridation when they received the treatment as chil-

Clair N. Sawyer
Prof. Sanitary Chem.
M.I.T.
Cambridge, Mass.

Mark F. Cracker
Commissioner
Water Supply
Newton, Mass.

Truman H. Safford
Southern Manager
Chas. T. Main Engrs.
Charlotte, N. C.

Paul A. Coffman
Chief Engr.
Omega Mach. Co.
Providence, R.I.

Programmers

George Wood
Chief Engr.
Bd. Water Commrs.
New Britain, Conn.

Dr. F. E. Law
Dental Consultant
U.S. Pub. Health Serv.
Boston, Mass.

dren; the treatment is preventive only. The greatest protection against dental decay is needed in low-income families; a survey in Maine showed only 30 per cent of children received as much as 1.5 pints of milk per day; in another survey, that amount was received by 44 per cent of white children and 24 per cent of Negro children. Children most needing protection would obviously not obtain it from fluoridated milk. Above all, the control and supervision of fluoride concentration would be far more difficult if milk were used as the vehicle for fluoridation.

GEORGE WOOD, Chief Engr., Board of Water Commissioners, New Britain, Conn., presented a discussion of experience in fluoridating the water supply of New Britain. He reviewed the recommendations and investigations extending from 1949 to the present. The treatment was placed in operation in November 1950, but there were interruptions due to chemical shortages, and continuous operation started in April 1951. Two feeder installations were required: one for a ground water supply, and one for a filtered surface supply. Auxiliary equipment includes dust collecting devices. There is no additional labor charge.

Costs were given as $2.17 per mg for chemicals, and $3.65 per mg for amortization of equipment and all other costs: This is a total of 15 cents per capita per year. The white granular grade of sodium fluoride has been found to be practically dust free. No difficulty has been experienced in maintaining uniform dosage in fluoridation treatment.

PROF. C. N. SAWYER (Mass. Institute of Tech.) discussed Mr. McKee's paper in some detail, and many other members participated in the open discussion which followed. It was obvious that strong views were held by members taking both sides of the question.

According to Prof. Sawyer, nutritionists already have considered and discarded milk as the vehicle for fluoridation; if it were used, the cost would probably be in the vicinity of $3.65 per child per year—using Mr. McKee's own estimate.

W. J. SCOTT (Director, Conn. Bureau of San. Eng.) noted that special local conditions may, in some instances, make the cost of water fluoridation come well above the 10 to 15 cents per capita per year figure. Nevertheless, the cost of water fluoridation will be far less than that of any other method.

P. E. PALLO (San. Engr., Hackensack Water Co., New Milford, N.J.) questioned the need of calcium requirement in conjunction with fluoridation.

L. H. ENSLOW (Editor, *Water & Sewage Works*) cited experience with a naturally fluoridated supply, in Virginia, where the water contained no calcium but the 1 to 2 ppm. of naturally present fluoride provided good tooth protection.

"Water Magic"

"WATER MAGIC," by Fred S. Gibbs, President, Engineering Sales Corp., Newton Lower Falls, Mass., was the title picked for what would well be catalogued as "magic" in some previous time. When, as of today, one can take a hard or brackish water and by its passage once through a bed of mixed synthetic resins turn out a product equal to distilled water in the matter of seconds that spells "magic" in contrast with earlier laborious, time consuming and expensive processes of high pressure boiler water production.

Mr. Gibbs told of modern methods of producing process water for industrial uses wherein everything but the actual hydrogen and oxygen is taken out by passage through contact beds of synthetic resins and thereafter adding whatever salts might prove desirable in the processing water.

He related the advances from the ordinary zeolitic softeners which are regenerated with a brine solution, exchanging sodium ions for the ions of hardness (calcium and magnesium) and metallic ions such as manganese and iron. The largest municipal plant to employ zeolitic softening is the 200 mgd. plant of the Southern California Metropolitan Water District. From this point the next advance was for industrial use and involved synthetic resins regenerated with sulphuric acid. In this the calcium and magnesium is replaced by hydrogen, productive of an acidic water. Next step was to pass the acidic water through another resin bed regenerated with caustic soda. The end product is neutral with all positive and negative ions removed except the (H) and (OH). Result a product containing nothing but H_2O and carbon dioxide which aerates out readily.

Now the "magic" of today comprised the use of a single passage through a single bed of mixed resins—presto; pure water in a matter of seconds, and this is really pure water.

"Unlaxing" around the Griswold's pool

"Al" Johnstone
W. & T. Veteran
and Research Engr.
Stamford, Conn.

Edw. W. Moore
Prof. Sanitary Chem.
Harvard Univ.
Cambridge, Mass.

Allan M. Symonds
Dist. Manager
Am. Wtr. Serv. Co.
Wethersfield, Mass.

Karl R. Kennison
Chief Engineer
Bd. of Water Supply
New York City

Mr. Gibbs listed a number of industries now finding pure water an economic advantage. In high-pressure boilers of today such water is a must, since 0.5 ppm. total impurities in the boiler feed water comprises the upper limit for safe operation. Completely de-ionized water is being found to pay in producing pharmaceuticals, alcoholic beverages, ink, ice, soft-drinks, beer, photographic work, TV tubes, etc. To this end the mixed resin de-ionization bed is the miracle of today's *water purification* as contrasted to yesterday's *water treatment*.

In reply to questions Mr. Gibbs explained that in the larger installations the mixed resins are separated by a floatation process incident to acid and caustic regeneration followed by re-mixing. For the requirements of minor volumes of water such as by photographic houses cartridges of mixed resins are employed and discarded when exhausted. In many instances such cartridges marketed by Permutit and others will be the answer to complaints of city water quality by commercial establishments.

In industrial waste treatment use of the newer resins is solving the problem of removal of the heavy toxic metals such as chromium, copper, silver, lead, etc. The overall cost of removal is not unattractive in comparison with the cost of other methods of treating such wastes to a degree of acceptability by stream pollution control authorities.

Corrosion of Pipes

"STUDIES OF THE CORROSION OF WATER PIPE"—by John R. Baylis, Water Purification Engr., City of Chicago, Ill.

Mr. Baylis, talking principally from lantern slides, related their findings in Chicago concerning corrosion of water pipes and tuberculation of mains. Important was the conclusion that the tar-dip protective coating of cast-iron water pipes is not equal to that of earlier times when it was considered ample protection against tuberculation by Chicago water which is moderately hard. His conclusion was that *all* cast-iron pipe should be cement-lined in the future as a measure of "self-preservation" against competitive pipes which do not tuberculate.

It was his opinion that lime treatment to suppress corrosion was largely effective because of the calcium carbonate sealing of the porous tar-dip coating. Also the carbonate renders already formed tubercules less porous and thereby arrests corrosion which proceeds beneath the more porous tubercules.

Old Timers

Theo. L. Bristol
President
Ansonia Water Co.
Ansonia, Conn.

Caleb M. Saville
Consulting Engr.
Metro Water Bd.
Hartford, Conn.

(Mr. Saville is a three-time winner of the Dexter Brackett Medal for meritorious papers presented before the Association.)

Mr. Baylis showed a picture of a one inch service pipe removed at Danvers, Mass. The pipe was cement lined steel or wrought iron pipe. It had been in service from 1876 to 1928 (52 years). Although all of the calcareous portion of the cement has long since been dissolved out and only the skeleton silica structure (lacy in character) remained the pipe had corroded but slightly on the interior. The failure was from the outside, due to soil corrosion. Within the skeleton of silica a layer of iron rust had been formed to seal off the contact of the corrosive water with the metal of the pipe.

A portion of Mr. Baylis' illustrated talk was tagged by himself as "off the record remarks" and therefore not subject to reporting in this publication. We frankly couldn't see why this prohibition, since his statements concerning the Chicago findings would hardly be considered "news" to most water works men dealing with corrosive waters—certainly not to New England water works men.

In the discussion period Mr. Baylis stated that dormant tubercules were usually dark in color and more dense, while active tubercules, with pitting active beneath the tubercule, were usually of a brighter color and soft.

He said that a seal coat for cement linings was desirable but judging from the history of the Danvers pipe (52 years in service) and others of a lesser age, even when the cement lining had become void of the cement, corrosion and tuberculation was not to be expected to any major extent.

Pumps and Pumping

"PUMPS AND PUMPING STATIONS" by Richard Hazen, Consulting Engineer, New York, N.Y.

In a paper pack-jammed with valuable basic information required in connection with the design of pumping arrangements and selection of pumps and auxiliary equipment, Mr. Hazen had too little time to cover the ground and answer pertinent questions. For the most part his paper dealt with small and moderate sized pumping problems.

First, said Mr. Hazen, the economic picture when considering a gravity supply vs. a pumped supply, has changed in recent years. The improved efficiency of centrifugal pumps and the down trend in electric

"Ja" Harper
Dep. Mgr.
Pittsburgh Meters
New York, N.Y.

Francis L. Hatch
Superintendent
Kittery Water Distr.
Kittery, Me.

Walter E. Williams
Sanitary Engr.
Naugatuck Chem. Co.
Naugatuck, Conn.

Warren J. Scott
Chief Engineer
State Dept. of Health
Hartford, Conn.

rates makes pumping less expensive while the cost of materials and labor required in gravity systems have mounted in cost markedly.

The modern, automatic pump station controls and alarm systems reduce the man-hour cost of station supervision.

Mr. Hazen stressed the importance of comparing the standard stock models of various pump manufacturers in order to select the most economical units for the specific requirements, considering long-time operating efficiency and costs rather than immediate or first costs.

In the consideration of space requirements and practical operating considerations the vertical pump is coming into greater use. In general the vertical pump is just as efficient as the horizontal pump. Shafting and bearings have been improved, priming is not required and there is no danger of loss of suction. In connection with motor drive, the motors can be located as high as required to preclude flood submergence. In connection with engine drive, efficient right angle gear-drives are available.

In general it is more satisfactory to provide for a combination of pumps of various capacities with automatic sequence of cut in and cut out than to depend upon variable motor speed to meet changing demands. Also in general there has been a lack of adequate stand-by pump capacity for a service as important as water supply.

In parallel pump operation connecting into a common header, marked care must be taken in the design study if efficiency and operating economy is not to be sacrificed. A feature not always given consideration deserved is the design of suction wells or sumps if interference with intake efficiency is not to result.

Mr. Hazen showed lantern slides to illustrate his points in the great economy attainable through careful engineering study of pumping efficiencies resulting from various combinations of pumps and discharge header design as well as suction pit dimensions. He pictured typical recent designs of pumping stations and outlying booster stations housed in nothing more than cubicles in which vertical turbine pumps and automatic control equipment is housed. Such stations are mostly employed where cold weather is not a consideration.

Programmers

Fred S. Gibbs
President
F. S. Gibbs, Inc.
Boston, Mass.

John E. Baylis
Purification Engr.
Div. of Water
Chicago, Ill.

F. W. Gilcreas
Ass't Director Labs.
State Dept. Health
Albany, N.Y.

Richard Hazen
Consulting Engr.
Hazen & Sawyer,
New York, N.Y.

All in all Mr. Hazen's paper constitutes a valuable reference article for anyone faced with the selection of pumping equipment and design of pumping stations. With respect to the hazards of water hammer and potential damage to pumps and piping he recommended the paper by Logan Kerr on "Water Hammer" in the AWWA Journal, December 1951, which provides a valuable check list.

In the discussion, L. H. Enslow, commented on the fact that in several instances recently automatic booster pumping on existing gravity supply lines had proved the more economical measure of increasing supply delivery into town than that of providing a parallel gravity line. This matter of pumping water "downhill" had a novel slant, but seemed to have numerous applications.

The London Supply

"London, England, Water Supply," by Henry F. Cronin, Chief Engineer, Metropolitan Water Board, London, England.

Mr. Cronin presented briefly and interestingly the 350 year background of London's water supply problems. The present area of the city, approximately 50 x 50 miles, requires about 540 mgd. of water in U.S. gal.: this is obtained from the Thames River (2/3), from the Lee River (1/6), and from underground sources (1/6).

In England, provision of water is considered a health service. Charges are established on the basis of the rateable value of property, and about two-thirds of the supply is metered. New homes for the working class (which represents practically all present construction) include more water taps and more hot water systems—thus will account for increased water needs. The Board has 230 inspectors engaged in leakage surveys at the present time and the repair of leaks is accomplishing reductions in consumption.

Specific problems which the Metropolitan Water Board must face are: pollution (all sources), falling water levels in wells, and needs for increased storage. Rapid sand filters are used as prefilters ahead of the slow sand filters, though new micro-strainers are proving almost of equal value for algae removal. The micro-strainer units are 10 ft. in length and 10 ft. in diameter; they utilize extremely fine wire mesh (80,000 per sq. in.); and require only 6 ft. head loss instead of the 8 ft. required for prefilters.

The entire London supply must be pumped; power used is 68% steam, 9% oil, and 23% electric. Only electric power installations are now being made, but all these include Diesel standby units. The distribution system is old—much is aged 100 years or more—and averages 2000 "bursts" per year, one for each 2.5 miles of pipe.

In discussion of the paper, E. A. Schmitt (Chief, Washington, D.C., Aqueduct) was told by Mr. Cronin that London still retains biological growth on the surface of its slow sand filters. Mr. Schmitt pointed out that on the Washington, D.C., filters

Around the Griswold pool during the Aquatic Show

biological growth has been eliminated by prechlorination and that mechanical cleaning is employed.

MR. CRONIN discussed the requirement that household storage systems be provided in all houses. This insures that fittings will come under no greater pressure than that provided by the elevated tank—it reduces waste and also permits water supply to be shut off for a short period.

Studies of U-V Treatment

"APPLICATION OF ULTRA-VIOLET RAY STERILIZATION TO WATER TREATMENT," by F. Wellington Gilcreas, Asst. Director, Chemical Laboratories, State Dept. of Health, Albany, N.Y.

The limitations and drawbacks characteristic of early ultra-violet devices marketed for disinfection of small water supplies and swimming pools were described by Mr. Gilcreas. Chlorination replaced these installations.

Recently, new low temperature (70° to 80° F) ultra-violet light generators have been marketed for water disinfection and one such unit has been extensively investigated by the N.Y. State Division of Laboratories and Research. The unit provides 6 lamps arranged in a series of highly polished reflecting tubes; water passes through a spiral tube and is exposed in a ½ in. deep layer. Capacity of the unit is 750 gal. per hr., which provides a 4.2 sec. exposure in a 15 ft. length of flow.

The results of bacteriological studies showed complete kill would result in operation at the rated capacity of the unit (using Albany tap water seeded with coliform test organisms, density ranging from 2,400 to 240,000 MPN). More critical studies demonstrated that at least 4 lamps must be in operation (giving 2.8 sec. exposures) to insure disinfection. Maintaining clean tubes and reflectors proved essential.

The limiting values of several constituents were determined: Inorganic turbidity (Fuller's Earth), 75 ppm; Organic turbidity (skim milk), 30 ppm; Color (tea) 90 ppm; and ferric iron, 5 ppm. These values proved to be higher than had been expected. A water temperature of 41°F was used in these studies; a proportional reduction in efficiency would occur if water temperature was reduced to 5°F.

Thus, the modern U-V device appears suitable for disinfection of small water supplies when proper conditions obtain. The limitations must be recognized and frequent cleaning will be essential.

1,032 Water & Sewage Projects Approved for 2nd Quarter by Water Div. of N.P.A.

Dollar Total over $500,000,000

The Water Resources Division of the National Production Authority, James Crenshaw, Director, has issued a new detailed list of Water & Sewage Projects which were approved and received allocation of all necessary materials under the Controlled Materials Plan for the Second Quarter, 1952. Water Supply Projects total $271,830,958. Sewage Projects $282,252,593, to make the impressive total of $554,083,551.

Added to the value of projects approved for the First Quarter* the total value of approved projects for the First Half of 1952 is $1,128,095,744.

The consolidated list of approved projects by State totals follows:

PROJECTS APPROVED BY WATER RESOURCES DIVISION OF THE NATIONAL PRODUCTION AUTHORITY

Second Quarter 1952, Controlled Materials Plan Allotments.
(April 1, 1952 - July 1, 1952)

State or Territory	Number of Projects	Value of Projects	
		Water Projects	Sewage Projects
Alabama	16	$ 2,184,802.00	$ 363,642.00
Arizona	12	6,420,623.00	—
Arkansas	7	543,467.00	138,530.00
California	160	41,032,577.00	31,786,452.00
Colorado	13	16,602,041.00	590,709.00
Connecticut	4	171,000.00	830,000.00
Delaware	4	2,947,349.00	—
Dist. of Columbia	9	3,059,814.00	5,783.00
Florida	15	11,238,133.00	393,000.00
Georgia	14	2,732,095.00	2,014,641.00
Idaho	7	425,500.00	165,000.00
Illinois	30	26,784,575.00	13,377,766.00
Indiana	18	4,067,007.00	5,098,166.00
Iowa	18	411,438.00	1,776,371.00
Kansas	15	2,291,016.00	557,534.00
Kentucky	10	1,332,077.00	6,000,000.00
Louisiana	16	3,701,065.00	1,624,217.00
Maine	21	5,807,500.00	7,423,037.00
Massachusetts	18	3,414,900.00	11,019,800.00
Michigan	44	7,403,949.00	81,983,736.00
Minnesota	21	456,621.00	1,887,216.00
Mississippi	9	433,583.00	440,000.00
Missouri	17	3,469,012.00	435,066.00
Montana	5	1,081,300.00	100,000.00
Nebraska	6	—	986,896.00
Nevada	2	89,400.00	—
New Hampshire	2	169,628.00	—
New Jersey	19	2,526,900.00	41,957,219.00
New Mexico	2	151,400.00	—
New York	48	28,660,973.00	9,571,927.00
North Carolina	19	4,338,791.00	529,227.00
North Dakota	9	638,340.00	969,052.00
Ohio	50	11,076,549.00	15,353,004.00
Oklahoma	14	2,807,375.00	1,565,105.00
Oregon	22	6,864,027.00	3,513,354.00
Pennsylvania	50	15,890,340.00	11,072,668.00
Rhode Island	4	51,800.00	3,507,349.00
South Carolina	13	858,021.00	453,270.00
South Dakota	7	1,261,000.00	490,275.00
Tennessee	14	1,393,313.00	2,000,000.00
Texas	112	33,319,394.00	4,448,629.00
Utah	9	618,645.00	160,000.00
Vermont	1	220,000.00	—
Virginia	29	3,664,678.00	5,740,044.00
Washington	30	1,037,766.00	1,607,120.00
West Virginia	8	763,122.00	—
Wisconsin	21	2,479,193.00	2,044,725.00
Wyoming	1	150,000.00	—
Alaska	1	7,050.00	—
Hawaii	23	2,076,580.00	1,572,768.00
Puerto Rico	12	2,705,729.00	6,574,295.00
TOTAL	1,032	$271,830,958.00	$282,252,593.00

*Published in W. & S. W. for August 1952—page 334.

Fig. 1—LIQUID CHLORINE for water chlorination in 1912 came from this plant

How Modern Chlorination Started

The Story of the Solution Feed Process As It Began Forty Years Ago

by HARRY A. FABER, *Assoc. Editor, Water & Sewage Works*

NO bronze plaque marks the spot, but an event of historical significance took place at Niagara Falls, N.Y., on November 22, 1912. The turning of a valve on that date has affected the lives of millions of people throughout the world.

When that valve was turned, chlorine gas (released from a cylinder of liquid chlorine) was dissolved in water and the solution was used to disinfect a public water supply. This simple sequence of control had never before been followed. It marks, therefore, the practical beginning of what is termed solution feed chlorination.

The equipment used that day did not come into being without a background of trial and error. Actually, it represented the culmination of studies started more than two years previously.

Looking backward, it is evident that the year 1912 may be considered a turning point in man's fight against water borne disease. Prior to that time, it had been shown that the chlorination of water and sewage, by the application of a solution of chlorinated lime, would effectively control disease-producing bacteria. Such treatment was already in use, but was destined never to become widely adopted—largely because of problems relating to accurate feeding and control.

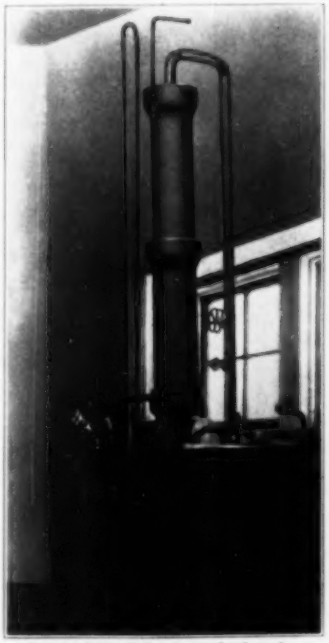


Fig. 2—EARLIEST solution feed equipment to treat a public water supply

In 1912, however, fate had marked a number of men whose names were destined for a permanent place in the story of chlorination. The names are Darnall, Ornstein, Huy, Kienle, Wallace and Tiernan. They deserve recognition because the basic principles they developed have led to the important chlorination practices used today.

First—Gaseous Chlorine

The record[1] shows that as early as 1896 William M. Jewell briefly used chlorine gas for the disinfection of filtered water. His studies were made at the experimental filter plant in Louisville, Ky. The chlorine gas was produced by means of a dynamo which decomposed brine in a series of small glass cells. Three years later, he again used his electrolytic equipment at Adrian, Mich., before turning to the use of chlorinated lime for disinfection.

Next—Chlorinated Lime

In 1908 George A. Johnson made the first technically successful application of chlorination in America

NOVEMBER 14TH TO 21ST

Using 30# of hypochlorite of lime per day, based on a pumping average of 6,000,000 gallons per day

Dates 1912	Bacteria per c.c. Raw water	Tap water	Turbidity in parts per million	Amount of sulphate alumina used. In grains per gallon.
Nov 14th	26,150	42	60	1.78
15th	18,500	28	70	1.82
16th	14,960	15	80	2.01
17th	22,510	29	80	1.92
18th	19,280	19	55	1.84
19th	21,650	20	80	2.00
20th	16,780	38	60	1.63
21st	19,310	38	90	1.98
Average	20,018	26	76	1.87

NOVEMBER 22ND TO 24TH

Using 3# of Liquid Chlorine per day in the filtered water, based on a pumping average of six million gallons per day.

Nov.22nd	16250	28	80	1.60
23rd	16500	11	75	1.53
24th	20250	16	70	1.72
Average	17700	18	75	1.68

NOVEMBER 26TH TO DECEMBER 1ST

Using 1# of the Liquid Chlorine per day in the filtered water, based on a pumping average of six million gallons per day.

Nov.26th	23650	56	55	1.74
27th	29650	34	75	1.69
28th	20780	32	65	1.91
29th	21050	42	110	2.18
30th	20350	39	90	2.07
Dec. 1st	21500	56	80	1.96
Average	22797	40	84	1.92

DECEMBER 2ND TO 8TH

Using 1# of liquid Chlorine per day in the filtered water, based on a pumping average of six million gallons per day.

Dec. 2nd	24120	30	100	2.21
3rd	26300	30	110	2.48
4th	31000	34	520	2.51
5th	27100	60	180	2.43
Average	27130	33.5	227.5	2.42

Fig. 3—LABORATORY RECORD of chlorination results

when he demonstrated that the raw water treated by the Bubbly Creek filter plant in the Chicago Stockyards could be disinfected by a solution of chlorinated lime. Later the same year, John L. Leal and Johnson started full scale treatment of the 40 mgd water supply of Jersey City, N.J., applying chlorinated lime solution at Boonton, N.J., the headworks of the supply.

Early in 1909, chlorinated lime treatment was initiated at the Poughkeepsie, N.Y., water supply—and, during the next few years the use of chlorinated lime for treatment of water and sewage slowly expanded. Adoption of this treatment was slow principally because chlorinated lime (the bleaching powder of commerce) was unstable, unpleasant to handle, and relatively expensive in terms of chlorine. Fortunately, the production of liquid chlorine in the U.S. stimulated the wider use of water and sewage chlorination.

Then—Liquid Chlorine

Chlorine gas, drawn from a steel cylinder containing liquid chlorine, was first used for water disinfection by Major Carl R. Darnall,[2] who designed and operated experimental equipment at Fort Meyers, Va., in 1910. Major Darnall considered that, in order to obtain the highest efficiency in disinfection, the chlorine should be applied directly to the water being treated; that is, in the form of "anhydrous" gas.[3]

The pioneer production of liquid chlorine in the U.S. was undertaken in 1909 by the Electro Bleaching Gas Co. in its Niagara Falls, N.Y., plant. It was E. D. Kingsley, Founder and President of the company, that Major Darnall approached late in 1911 for exploitation of his patented chlorine feeding equipment.

Major Darnall intended to arrange license agreements with communities to install his equipment for water disinfection. Under that arrangement, the community would pay him a yearly royalty based on either a fixed amount per year per capita or on the number of million gallons of water treated. He proposed that all the liquid chlorine used in his installations be supplied by the EBG Co. and, in return, the company should agree to sell liquid chlorine for this purpose to no one else.

Mr. Kingsley agreed to Major Darnall's proposition with the provision that the Darnall chlorine feeding device should be available in working form within six months. The time limit passed without such equipment being made.

A New Approach

Thereupon, Mr. Kingsley considered that his company should endeavor to develop a practical means of applying liquid chlorine for water disinfection. He assigned the job to Dr. Georg Ornstein, then consulting chemist for EBG Co. (employed to develop applications for liquid chlorine in bleaching textiles and paper pulp).

In June of 1912, Dr. Ornstein began his experiments in the EBG Co. plant. At that time, the plant consisted of several one-story wooden sheds (see Fig. 1). These buildings were rented from Roberts Chemical Co., from which EBG Co. also purchased the chlorine gas used to produce the liquid chlorine.

Dr. Ornstein soon developed an adsorption tower constructed of two tile pipes, 4 in. in diameter and 6 ft. high. The lower tile pipe was provided with a T-outlet, and the bottom opening was sealed with cement covered with pitch. The T-outlet was sealed in the same manner but contained two openings; one for introducing chlorine gas, and another for connecting one leg of a water seal.

The tower was filled with lumps of pumice, and water was supplied at the top by means of a pipe and regulating valve. Chlorine gas was thus forced to travel upwards in the tower, and to dissolve in the water trickling downward; the solution was discharged through the water seal connected to the lowest opening in the tower. The cylinder valve was used for crude adjustment of the rate of chlorine gas flow.

Tests in a Water Plant

After trial runs proved the new equipment to be practical and safe, Mr. Kingsley asked Harry F. Huy, then manager of the Western New York Water Co., for permission to demonstrate it in the utility's filtration plant (Fig. 5). This demonstration was planned for full scale treatment, using chlorine in comparison with the chlorinated lime treatment which was in use at the plant at that time.

Mr. Huy approved of the demonstration, and equipment was set up

in the room housing a concrete tank used to feed chlorinated lime solution. The chlorinating equipment, shown in Fig. 2, included certain refinements over the experimental device.

The rate of chlorine gas discharge from the cylinder to the tower was regulated by a special valve having a reduction gear operating the spindle and permitting very accurate adjustment of flow. A shut-off valve in the same line made it unnecessary to disturb the setting of the special valve. A long inverted U-tube of hard rubber, ¾ in. diameter, reaching above the top of the adsorption tower prevented the sucking back of water. The chlorine-water solution flowed from the bottom of the tower through a pipe leading to the concrete storage tank. Vents were provided from the top of the tower and from the covered storage tank to the outside of the building.

From the tube at the bottom of the tower, chlorine-water solution was drawn for analysis. This analysis determined the chlorine content and thus the amount of solution required for the volume of water being treated in the filter plant. The feed of chlorine water was adjusted at an orifice box on the outlet of the storage tank, the storage tank serving to equalize varying rates of flow of the incoming and outgoing chlorine-water solution.

Solution Feed is Started

In November of 1912 the equipment was ready to operate. For a control test to compare this new method of treatment with the results obtained using chlorinated lime, an 8-day run was made with the latter treatment. Transcripts from the laboratory records of the Western New York Water Co. show the bacteriological and chemical data obtained in the period, from November 14th to 21st inclusive (see Fig. 3).

The solution feed application of chlorine gas was started on November 22nd and was continued through the 24th. The record shows this application of 3 pounds of chlorine per day accomplished better bacterial kills than 30 pounds of chlorinated lime; in these and the following tests 6.0 million gallons of water were treated daily.

These results so exceeded expectations that, for the next test run of one week, the chlorine applied was reduced to 1 pound per day. On the basis of bacteriological results, however, it was considered advisable to increase the dose to 1.5 and then to 2 pounds per day.

The results of the last test run shown (see Fig. 4), from Feb. 7th to 20th, 1913, are of particular interest as they show the effect of applying double chlorination—using 6.5 pounds of chlorine in the raw water (added in the suction well prior to adding alum) and using 2.5 of chlorine in the filtered water (where it had been added in previous tests). This run indicated that a considerable saving of coagulant could result from chlorination of the raw water.

DECEMBER 6TH TO 10TH

Using 2# of liquid chlorine per day in the filtered water, based on a pumping average of six million gallons per day.

Date	Bacteria per c.c. Raw water	Bacteria per c.c. Tap water	Turbidity in parts per million	Amount of sulphate alumina used. In grains per million
Dec. 6th	20615	36	170	2.50
7th	19250	46	200	2.47
8th	22900	34	190	2.13
9th	20700	39	220	2.23
10th	21400	37	260	2.48
Average	20973	38	208	2.36

All of the foregoing result are based on the using of liquid chlorine and hypochlorite of lime in the filtered water. At this plant it is not possible to obtain very good results by the use of hypochlorite in the raw water as we had to use so much hypochlorite to obtain results, and it had a tendency to produce a taste in the water, which we found to be the case if we used over 6# of hypochlorite of lime per million gallons.

The following results are from the use of 2# of liquid chlorine per day, based on pumping average of approximately 5,000,000 gallons per day, of which about 2½# was introduced into the filtered water and 6½# into the raw water before the introduction of the sulphate of alumina.

1913				
Feb. 7th	20050	27	120	1.15
8th	18500	49	120	1.14
9th	14800	43	130	1.08
10th	21150	66	140	1.06
11th	16250	40	110	.94
12th	23400	34	120	1.02
13th	19500	29	90	1.02
14th	18200	28	90	1.10
15th	15700	49	80	.97
16th	19600	61	70	1.08
17th	15450	20	60	1.15
18th	21300	25	65	1.00
19th	21000	22	110	1.04
20th	21650	28	100	1.66
Average	19039	37	100	1.10

It will be observed that the results from Feb. 7th to 20th show a marked reduction in the amount of sulphate of alumina used in comparision with that shown in the preceding tables.

Fig. 4—LABORATORY RECORD includes double chlorination

Refinements are Added

While these tests were being conducted, efforts were being made to improve the construction and operation features of the equipment. Improved gas flow regulating and metering devices appeared particularly necessary.

New equipment was designed which comprised a manifold with shut-off valves for connecting several chlorine cylinders, and two pressure-reducing valves placed in series. The first pressure-reducing valve held to about 15 lb. the chlorine pressure which, in the cylinders, varied (according to temperature) from about 60 lb. to 90 lb. The second pressure-reducing valve served as a regulating valve, operating in conjunction with a calibrated orifice disk in the downstream line and a pressure gage in the side line between the valve and the orifice. The pressure gage was calibrated empirically to indicate the rate of chlorine flow in ounces and pounds per hour.

A safety device was included to prevent moisture from moving back from the adsorption tower to the feeding device. This consisted of a spirally wound tube of narrow diameter which extended vertically and through which the chlorine gas passed to the adsorption tower.

Dr. Georg Ornstein applied for a patent on this new "process of antisepticizing water." The patent was granted and was assigned by him to the Electro Bleaching Gas Co. Of basic importance is the fact that the patent covered:

"In the sterilization of flowing water, the process which comprises establishing a separate minor flow of water, contacting chlorine gas with such flow to produce a solution

Maj. Carl R. Darnall

Dr. Georg Ornstein

Harry F. Huy

John A. Kienle

NAMES in the history of solution feed chlorination

and thereafter supplying the water so treated to the main body of flowing water to be sterilized."

The substance and claims of the patent have been upheld in a number of legal decisions.

Commercial Equipment Developed

Meanwhile, in December 1912, John A. Kienle, engineer of the Wilmington, Del., water works had started experiments of his own with liquid chlorine for water disinfection. These, he reported[7] "at first were rather discouraging," but he profited by work under way at the Belmont filter plant in Philadelphia and acted "upon ideas advanced by Dr. Ornstein." Kienle temporarily solved problems of chlorine absorption by using a tower of eight-inch cast iron pipe.

The first EBG unit to incorporate improved flow regulating and metering devices—the second full scale solution feed device—was installed in the Wilmington Water Works and started operation on February 1, 1913. In the same year, similar commercial equipment was purchased by the city of Philadelphia[8] and the installation of 10 units (two for each of the five pumping stations) was completed in November, 1913.

Allen Hazen, consulting engineer, visited the Philadelphia plants to examine the equipment for solution feeding of chlorine: he termed the installation "an epoch making development."

John Kienle, shortly thereafter, became associated with the EBG Co. to manage the sales of its chlorine feeding equipment. For a few years, under his guidance, more installations of this equipment were made in both water and sewage treatment plants. However, the EBG equipment was soon destined to become of only historical interest.

New Names in Chlorination

For two new names were becoming recognized in chlorination treatment: Wallace and Tiernan[9]. The association of C. F. Wallace and M. F. Tiernan began when they organized a shop to make various mechanical devices in New York City about the middle of 1909. By 1911 they were connected with the feeding of chlorinated lime for water disinfection, and by 1912 they had invented and were manufacturing "various gadgets for handling hypochlorite solutions."

In the fall of 1912, Mr. Tiernan suggested the use of chlorine gas to be applied at Dover, Del., for disinfection of water supplying the Boonton Reservoir of the Jersey City Water Department.

Wallace and Tiernan devoted their efforts to developing a simple, direct feed device for measuring and feeding gaseous chlorine. The first unit they produced is illustrated in Fig. 6.

The W & T chlorinator included a chlorine gas pressure gage, a compensating device to equalize variations in gas pressure, and an ingenious inverted siphon (made of glass) for measuring the low rates of chlorine gas flow. Chlorine gas was applied directly to the water being treated, and was dissolved in it by means of diffusers.

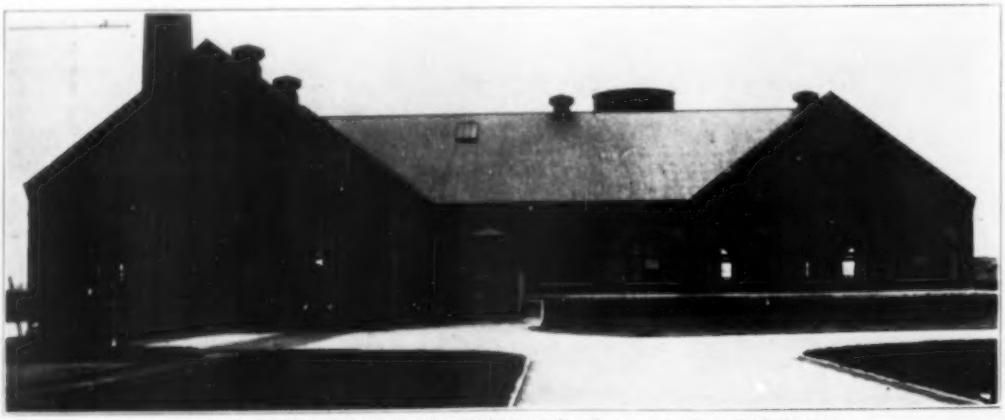


Fig. 5—FILTRATION PLANT, Western New York Water Co.—first to use solution feed chlorination

The first W & T machine was installed at Dover, Del., and started operation on February 22, 1913. This new chlorinator was simple and dependable in operation, and these features accounted for its rapid acceptance.

While direct feed chlorinators continued for a long time to fill a need in the water treatment picture, this equipment had its limitations. In cold climates, chlorine gas diffusers would frequently clog because of the accumulation of crystalline chlorine hydrate, which is formed when chlorine reacts with water at a temperature of about 49° F or lower. Solution feed devices for feeding chlorine are not seriously affected by this limitation.

Late in 1913, W & T began to develop solution feed chlorinators,

Fig. 6—C. F. Wallace and M. F. Tiernan and their first direct feed chlorinator

and these steadily assumed greater importance than the direct feed devices. In 1917, the firm became sole licensee of the Ornstein patent, and the EBG Co. discontinued marketing its liquid chlorine feeding equipment.

Years of development have followed, and solution feed devices filled a growing need for the accurate application of larger and larger quantities of liquid chlorine.

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Further Easing of Materials for Water, Sewage and Industrial Waste Needs

Reclassification of water and sewerage industry projects to improve their claim on scarce materials in case of a future national emergency was recommended today by the Water and Sewerage Industry Advisory Committee in its meeting with the National Production Authority.

Members of the industry heard Gerald E. Arnold, retiring Director of the NPA Water Resources Division, explain provisions of proposed relaxations of construction regulations to become effective April 1, 1953.

Under the proposed Direction 8 to CMP Regulation 6, projects of the industry would be classified under "all other" construction projects and as such would be permitted to self-authorize quarterly allotments of up to 25 tons of carbon and alloy steel, including structural (not to include more than 2½ tons of alloy and no stainless); 5,000 pounds of copper, and 4,000 pounds of aluminum for each project in any quarter.

At present water and sewage utilities may self-authorize only five tons of carbon steel (not to include more than two tons of structural but no wide-flange beams or sections); 1,000 pounds of copper and 2,000 pounds of aluminum for one project in a quarter.

Mr. Arnold said it is also proposed to raise the dollar limit on DO-rating authority for purchase of non-controlled building equipment and production machinery. The current limit of $5,000 for production machinery for "all other" construction would be raised to $200,000.

Industry members agreed the relaxed regulation would mean a considerable saving of time and effort for them by allowing the self-authorization of larger amounts of materials. However, they felt that the water and sewage industry should be reclassified as a separate entity rather than be included in the "catch-all" category of "other industry."

Members pointed out that little is gained by cutting down requests for materials allotments made by the water and sewage industries. The inevitable result is use of non-lasting substitute materials or construction of inadequate systems that in the long run prove far more mostly to the public.

A canvas of committee members indicated that up to now the industry had not suffered greatly from steel shortages resulting from the strike.

"I'M FROM THE SEWAGE PLANT, YOU'RE PLUNGING THAT THING TOO HARD!"

Crenshaw Heads Water Resources Div.

James C. Crenshaw is the new head of the Water Resources Division of the National Production Authority, succeeding Gerald Arnold who recently resigned to accept the position of Director of Water for Philadelphia.

Mr. Crenshaw has served the Water Resources Div. since its creation, having previously served in the Utilities Division of the War Production Board of World War II. His fitness for the position is further attested by the fact that since 1928 he has been connected with The American Water Works Co., except for the four years he spent in the U.S. Navy as a commissioned officer during World War II.

Jim Crenshaw, a southerner born in Pelzer, S.C., is a 1923 graduate mechanical-electrical engineer from Clemson A & M College of South Carolina.

Water and Sewage Works authorities will find that Gerry Arnold has left the Water Resources Division in capable and understanding hands. Mr. Crenshaw is serving on leave of absence from American Water Works Co., to which he will return.

North Carolina's Annual School for Water Works Operators

Instruction and Laboratory Courses at Duke University advance Association's Voluntary Certification Program

by W. BREWSTER SNOW, *Assoc. Prof., Dept. of Civil Engineering, Duke Univ., Durham, N.C.*

THE thirteenth annual Water Works School of the North Carolina Water Works Operators Association was held at the College of Engineering, Duke University, August 18 to 22. This school is conducted each year with the sponsorship of the North Carolina Section, A.W.W.A., the State Board of Health, and the North Carolina League of Municipalities. It is held in rotation at the School of Public Health, University of North Carolina in Chapel Hill; at North Carolina State College in Raleigh; and at Duke University in Durham. The 1952 School had a larger enrollment than any previous one with a total of 120 operators of municipal and industrial water supplies registered.

Operating in conjunction with the voluntary certification program of the N.C.W.W.O.A., it is concluded each year with examinations for Grade A, B, and C Certificates prepared and given under the supervision of the Examiners Committee of the Association. At the conclusion of the recent school 33 persons took the examinations for the Grade C certificate, 18 for the Grade B, and 13 for the Grade A. Up until the recent school a total of 40 operators held the A Certificate, 56 held the B Certificate and 143 held the C Certificate.

The twenty-four hours of short school instruction and laboratory work for each group is set forth in the By-Laws of the N.C.W.W.O.A. For operators who held the A Certificate a more flexible program of lectures and demonstration for the Advanced Group is also held. A new feature of the program for the recent school was a two and one-half day program for operators of unfiltered supplies—wells, springs, and surface waters from protected watersheds.

New Officers Elected

At its annual business meeting, W. Gillies Brown, Asst. Supt. of the Durham Water and Sewer Dept. was elected President of the Association for the year 1952-53. Raymond E. Ebert of Winston-Salem was elected Vice-President, G. R. Reynolds of Leaksville was re-elected Secretary-Treasurer, Mr. E. R. Tull of Rockingham, new member of the Examiners Committee and Mr. E. A. Shook of North Wilkesboro, Chairman of next year's Nominating Committee.

The Association also adopted a committee report on district sections of the Association and changed its by-laws to permit the organization of such sections, the elected chairmen of which became vice-presidents of the parent association and members of its Executive Committee.

Water-Borne Disease

At the opening joint session for all groups, Dr. JOHN J. WRIGHT, Acting Dean of the School of Public Health, University of North Carolina discussed "WATER AND ITS RELATIONSHIP TO DISEASE."

In addition to the epidemic diseases that have long been associated with water-borne transmission, Dr. Wright also reviewed the situation with regard to infectious hepatitis, methemoglobanemia, dental fluorosis, and poliomyelitis. With regard to the latter, he noted that although the polio virus has been isolated from stools, domestic sewage and sewage effluents, and although the effectiveness of each step in conventional water treatment practice is as yet not definitive, the epidemiological picture of polio suggests some mode of transmission other than through water supplies.

Dr. Wright stated that "swimming pools are closed during polio outbreaks because the water washes off a protective coating of mucous in the nose and mouth. This coating is germicidal and may help prevent infection by the polio virus.

"Nothing definite is known at present about the effects of water purification treatment on the polio virus," he said, "Some scientists believe, however, that the virus is not destroyed by the ordinary concentrations of chlorine used in water purification."

Speaking on water borne diseases,

NEW OFFICERS of the North Carolina Water Works Operators Assn. Seated, left to right—Raymond E. Ebert, Vice-Pres.; W. G. Brown, President; and G. R. Reynolds, Secy.-Treas. Standing: E. A. Shook, Chmn. of nominating committee; and E. R. Tull, new member of examining committee.

THIRTEENTH ANNUAL school, N.C.W.W.O., 1952—Duke University

Dr. Wright pointed out that "the general reduction of such diseases should not lull us into a false sense of security. Improvement in water supplies has caused a tremendous decrease of outbreaks of water borne diseases," he said, "but unless vigilance is maintained, we may again have problems of disease epidemics."

Membrane Filter Demonstration

Dr. Robert P. Myers, Bacteriologist of the Environmental Health Center in Cincinnati gave a lecture-demonstration on the use of membrane filters in water bacteriology.

After reviewing the historical development of the membrane filters and giving the procedure for preparation of the enrichment media, the endo broth, and the fuchsin-sulfite mixture, Dr. Myers demonstrated the filtration procedure. The procedures for sterilization of the membranes by exposure to ethylene oxide vapor, by boiling, and by autoclaving were also presented.

Panel Discussions

Two panel discussions were included in the program for the Advanced Group. The first of these, moderated by W. A. Gardner, Sanitary Engineer for the Fieldcrest Mills at Spray, N.C., dealt with "Automatic Controls as Applied to Water Treatment Plants."

Participating in this panel were Robert P. Posey, Applications Engineer of the Westinghouse Manufacturing Corporation, R. H. Babcock, Assistant Manager of the Utilities Division, The Foxboro Company, and J. H. Henderlite, Sales Engineer for Wallace & Tiernan Co.

The second of the panel discussions, moderated by Dr. W. Brewster Snow, Associate Professor of Civil Engineering, Duke University, dealt with "Industrial Water Supplies —Quality Requirements and Treatment Problems."

Water supply for the paper industry was treated by Fred V. Doutt, Chief Chemist of the Champion Paper and Fiber Company of Canton, N.C. Water supply for power plants and air conditioning systems was discussed by R. Peele Hackney of the American Tobacco Company's Research Laboratory at Richmond, Va. The Research Director of Cone Mills Corporation of Greensboro, N.C., R. H. Souther, dealt with water supply problems in the textile industry. Frank W. Melcher of the Quality Control Division of the Coca-Cola Company, Atlanta, Ga., reviewed quality requirements and specialized treatment procedures employed by the bottling industry.

Mr. Melcher pointed out that water suitable for drinking purposes does not always answer the requirements of soft drink manufacture. "Water that is too alkaline destroys the tartness of soft drinks," he said, "and tiny solid particles in the water can cause loss of carbonation.

"Most soft drink bottling plants throughout the nation use municipal water supplies," he said. "The industry has noted a continuous improvement in the quality of water in various cities over the years."

DEMONSTRATION of membrane filter technique

Dr. Robert P. Meyers, bacteriologist of the U.S.P.H.S. Cincinnati laboratory illustrates use of membrane filter equipment to the advanced study group.

TASTE AND ODOR control laboratory

Instructors were Albert Hyndshaw (back to blackboard) and E. A. Sigworth (under clock) of Industrial Chemicals Div., West Va. Pulp and Paper Co.

Lectures to Advanced Group

ESKELL NORDELL, Administrator of Laboratories of the Permutit Co., treated the subjects of "IRON AND MANGANESE REMOVAL" and "ION EXCHANGERS" with illustrated lectures.

An excellent review of the various methods for determination of chlorine and for differentiation between free and combined chlorine residuals was presented by DR. HENRY C. MARKS, Director of Chemical Research for Wallace and Tiernan Co.

The new three-reel film on "CORROSION" was shown by FRANK L. LAQUE of the Corrosion Engineering Section of International Nickel Co. as part of his discussion of this topic before the Advanced Group.

Fluoridation Discussed in Joint Session

The subject of FLUORIDATION was presented at a joint session for the Advanced, A, and B groups in a two-hour session.

During the first hour, W. S. SITLER, Regional Water Supply Consultant of the U. S. Public Health Service, gave a progress report on the rapid expansion of fluoridated public water supplies in Region III comprising North Carolina, Virginia, West Virginia, Maryland and the District of Columbia.

"North Carolina is leading the region in the number of communities fluoridating," Mr. Sitler said. "Seven North Carolina towns and cities are now adding fluoride and 12 more have obtained fluoridation permits from the State Board of Health." He estimated that 40 per cent of the population served by public water supplies in the region will be drinking fluoridated water within the next six months.

"Although the process of adding fluoride to water supplies to cut tooth decay is relatively new in preventive dentistry," Sitler said, "actually the residents of many towns in this region have been drinking fluoride in their water for more than 50 years without knowing it.

"Fluoride is present naturally in significant amounts," he explained, "in at least 103 public water supplies in the area, most of them deep well supplies along the coastal areas. Some of these supplies contain exactly one part per million of fluoride, the same amount that many communities are adding to their drinking water."

A great deal of interest was shown in the method of fluoridation being employed in Portsmouth, Virginia, where a well water containing 4 ppm. fluoride is being mixed with the surface water supply following filtration to yield a water containing a 1.0 ppm. fluoride concentration in the blended water. Mr. Sitler also referred to the hydrofluorosilicic acid installation for the City of Baltimore where it is estimated that the cost of fluoridation will amount to about 3 cents per capita per year.

The second hour of session dealt with "LABORATORY PROCEDURES FOR THE DETERMINATION OF FLUORIDE IN WATER" and was presented and demonstrated by RAYMOND E. EBERT, Chemist for the Winston-Salem, N. C., Water Department.

Program Planners

Program committee members for the 1952 school were: Chairman, Earle C. Hubbard, executive secretary of the N. C. Stream Sanitation Committee, Raleigh; Dr. Snow; J. M. Henderlite of Wallace and Tiernan Co., Charlotte; W. A. Gardner, sanitary engineer, Fielderest Mills, Spray; C. Dwyer Umberger, State Board of Health, Raleigh; and J. R. Malone, Durham Water Department.

LABORATORY work for plant operators

Taste and odor control studies being made at N.C.W.W.O. school by Leonard Hoffstetler, Lenoir; Albert Hyndshaw (instructor); Willard Carswell, Newton; and E. A. Shook, North Wilkesboro.

Utilization of Sewage Sludge

Best Use of Sludge in Soil Conditioning Requires Data on Related Factors

by LE ROY W. VAN KLEECK, *Principal Sanitary Engr., State Dept. of Health, Hartford, Conn.*

THE use of sewage sludge as a soil conditioner has its roots in antiquity. The Mongolian race has maintained high soil fertility for many centuries by the application of human feces and other organic materials to the soil. F. H. King's book, "The Farmers of Forty Centuries" provides illuminating reading in this respect.

The current literature is replete with references to the use of sludge. The Federation's Manual of Practice No. 2, "Utilization of Sewage Sludge as Fertilizer" alone reveals a bibliography of 251 current references on the subject. The reader is thus adequately provided with reference material.

This paper deals with certain salient facts concerning sludge utilization which either deserve repetition or on which the attempt is made to cast new light. Believing the old axiom that one picture is worth a thousand words the author recently presented pictorial evidence of the benefits of sludge in soil fertilization on his own premises.*

Sludges and Fertilizers

It is increasingly apparent that intelligent use of both sludge (or any humus material) *and* mineral fertilizer is necessary if either is to have maximum effectiveness for crop production.

Raw Primary Sludge

Raw primary sludge unless composted is unsatisfactory as a soil conditioner because of its effects on the soil and growing plants, and because of the health hazards involved.

Activated Sludge (Heat Dried)

Raw activated sludge after heat-drying is established as a superior sludge product. Such sludge retains most of its organic solids and it contains more nitrogen than other sludges.

In general, good crop growth is reported with raw activated sludge. The author would point out, however, that such sludge, if not well worked into the soil, encourages surface molds; odors may persist for some time from the decomposition of its organic matter. Some crop

MEMORANDUM ON USE OF SEWAGE SLUDGE AS A SOIL CONDITIONER

Dried digested sludge has been utilized in the past from sewage treatment plants in Connecticut as a source of humus or fertilizer for soils. Recently both technical and popular articles have appeared, pointing out the advantages of organic farming, so that a quickening interest in sludge utilization may be experienced.

The State Department of Health is concerned under the state law with the operation of public sewage treatment plants. There are outlined below the conditions under which sludge use on soils is permitted. In case of questions about sludge use, it is recommended that the local health officer be consulted and the health officers should always be advised in case of proposed transportation between towns. Superintendents and operators of sewage treatment plants are requested to see that all sludge users are informed of the following precautionary measures:

1. The spreading of raw (undigested) sludge in any form, unless heat-dried to a temperature of at least 1000° F. for ten seconds, should not be carried out. Septic tank sludge should be considered as raw sludge.
2. The discharge of liquid digested sludge on any land, other than the immediate grounds of a sewage treatment plant, is prohibited, unless the method employed and the discharge location are previously approved by the State Department of Health and the local health officer.
3. Air-dried, or vacuum filter dried, digested sludge, preferably stored for a period of several months, may be used on lawns, and the soil surrounding trees, shrubs, and flowers. It may also be used on land utilized for vegetable growing, provided the edible portion of the crops grow above the ground or the crops are such that they are cooked before eating.
4. In the case of vegetables grown in contact with the soil and eaten raw, dried digested sludge should always be applied to the soil the previous fall and plowed under either immediately or the following spring before the crop is planted. No additional applications of sludge should be made during the growing season.
5. Heat-dried sludge is safe for use under all conditions because of the destructive action of heat upon the bacteria.
6. The general public should be warned to avoid handling sludge with the bare hands and to wash the hands carefully with soap and hot water after sludge handling operations.

* See "This is the Lot that Sludge Nourished," *Water & Sewage Works, June 1952.*

SLUDGE GRINDER at Meriden, Conn. Ground sludge is ready for spreading

SLUDGE STORAGE at Greenwich, Conn. Concrete platform at Grass Island Plant

retardation may also be experienced immediately following its application unless the sludge is first composted with soil or harrowed into the soil for a time prior to planting the crops. Heat-dried activated sludge is safe hygenically. Not only pathogenic bacteria but also the cysts and ova of intestinal parasites and hookworm eggs are destroyed.

Digested Sludge

Digested sludges from all sewage treatment processes are materials of moderate but definite value as a source of slowly available nitrogen and some phosphate. They are comparable with farmyard manure except for a deficiency of potash. Their principal value is the humus content resulting in increased moisture-holding capacity of the soil and a change in soil structure which results in a greater friability. Like all humus materials, sludge stimulates the growth and propagation of angle worms which aid in soil aeration.

There is some loss of nitrogen when digested sludge is stored but this is not too significant. Seeds in sludge are effectively killed by digestion under heat except a few cucurbit and tomato seeds; these seeds are rarely a troublesome problem.

Reports of sickness traceable to use of digested sludges, either vacuum-filtered or air-dried, continue to be negative. Cram and Gilcreas have pointed out the potential hazard of transmission of parasitic infections with air-dried digested sludges as a result of handling the sludge or from sludge-contaminated vegetables eaten raw. Spreading of digested sludge in the fall and allowing it to freeze in cold climates in the winter is believed helpful in killing these organisms. Experience with actual parasitic infections is negative to date.

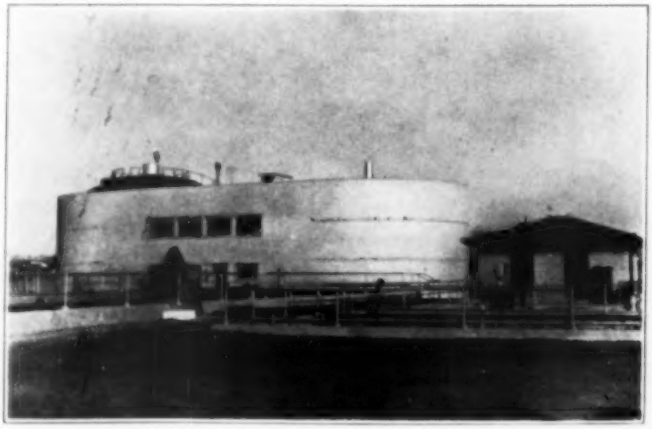
The author believes that if digested sludge used in cold climates is spread in the fall on land used for vegetables, then is ploughed or harrowed under in the spring (and no more is applied to the growing crops), health hazards from pathogenic bacteria or parasitic organisms may be avoided. To stipulate that certain vegetables which are eaten raw or grown in contact with the soil must not be grown in contact with air-dried digested sludge is a restriction which would make the use of this sludge of little value for the gardener who operates a small garden.

Grease

Grease of animal origin in digested or activated sludge may be considered harmless to soils. Excessive amounts of mineral oil, however, may well be detrimental. Raw primary sludge, not composted, may also cause soil clogging from grease.

pH of Sludge Cakes vs. Liming Requirements

The pH of heat-dried activated sludge is low, generally averaging 5.0 to 6.0. Air-dried digested sludge after a short period of storage will normally drop to about pH 6.0. Digested sludge cake conditioned with lime for vacuum filtration has initial pH values ranging from about 10.2 to 11.2, but this drops rapidly when it is mixed with soil or more slowly on storage, as a result of loss of



MODERN DIGESTERS—for raw primary sludge—at West Haven, Conn.

SLUDGE LAGOON at Putnam, Conn. Dry sludge can be dug out for use

SLUDGE DRYING beds at Plainville, Conn. Dry cake can be handled readily

ammonia. Tests show the pH of lime-conditioned sludges drops to about 7.5 in two or three days so that danger of too alkaline a soil should not occur from the use of such sludge.

Experience shows that the continued use of any type of sludge unless previously conditioned with lime requires the periodic addition of lime to the soil to prevent harmful acidity. The author's own experience using an elutriated digested sludge conditioned with ferric chloride is that liming is required about every three years to maintain a soil pH between 6.5 and 7.0.

Horticultural references give optimum pH ranges for vegetables, shrubs and trees. Liming requirements in conjunction with sludge applications must be based on these values. In general, most vegetables and shrubs do well in soil having a pH range from 6.0 to 7.0; pH values of 5.3 to 6.0 are satisfactory, however, for potatoes, pumpkins, melons, strawberries, raspberries, watermelons, peppers, eggplant and tomatoes. A higher pH range of 6.4 to 7.6 is desirable for asparagus, cauliflower, cabbage, cucumbers, peas, onions, beets, spinach and lettuce.

The purpose of liming soils is not so much to create a certain pH value for a particular crop as to set up a balance for proper utilization of the soil nutrients. Following are some of the reasons for liming:

1. Lime neutralizes excessive acidity.
2. It favors decomposition of the organic matter by bacteria.
3. It will improve the physical condition of heavy soils.
4. It supplies calcium, one of the elements needed by plants.
5. It makes phosphorus in the soil more available.
6. It increases the effectiveness of organic materials (sludge) and commercial fertilizers.
7. Lime will precipitate certain elements such as copper, aluminum, manganese or zinc, which are sometimes present in excessive amounts, thereby reducing their solubility in the soil and preventing harmful effects. This action of lime is discussed further under the next heading.

Soil long under cultivation, without adequate fertilization, such as commonly encountered in New England, is particularly benefited by lime applications. The lime should preferably be applied in the fall before using other fertilizers. Applications are usually at the rate of ¼ to 1 ton of hydrated lime (or equivalent) per acre. This amounts to about 2½ to 5 pounds per 100 sq. ft. In small plots of land, either hydrated or ground limestone may be used.

VACUUM FILTER at West Haven handling elutriated digested sludge

Certain Elements in Sludge and Their Effect

Spectrographic analyses of a number of digested sludges in Connecticut by the Connecticut Agricultural Experiment Station show relatively high concentrations of certain minor elements to exist as compared with other fertilizing materials. Thus the total zinc was found to range from 1700 to 3100 ppm, copper from 400 to 700 ppm, and boron from 130 to 360 ppm, even when no appreciable volume of industrial wastes is present in the sewage. The presence of so much zinc is attributed to gal-

vanized metal piping, brass piping, human feces and rubber articles, the latter containing zinc oxide used as a filler. Excessive zinc in the soil appears to have much to do with reducing the yield of certain vegetables. Likewise copper, while beneficial in moderate amounts,* can be harmful to crops when present in excessive quantities. Boron, while essential in small amounts, may also prove toxic when applied at rates greater than 50 pounds as borax per acre.

A correction for the detrimental effects of certain elements appears to be possible through lime applications. Lime will precipitate much of the soluble or available portion of these elements and reduce the amount available at any one time in the soil and hence that which will be taken up by the plants. Many users of sludge (where sludge has been applied to soil used for the growing of vegetables) have perhaps unwittingly avoided the harmful effects of these elements by periodic lime additions.

The author has noted no detrimental effects from these elements in sludge when sludge is applied to grass, trees or shrubs. So far as the author knows the effects appear to be limited to certain vegetable crops.

The usual iron content of sludges is not harmful to soils. Sludges conditioned with ferric chloride may be used with safety.

Nitrogen-Fixation by Bacteria in Sludge

A. H. Niles reports that the nitrogen-fixing bacteria in sludge transform nitrogen in the air to useful compounds available to food plants. These bacteria also attack and break down the humus present in the sludge and soil.

Sludge Application Rate Affects Crop Yields

There are indications that first crop yields are improved by low application rates of sludge to soils. Dr. Herbert A. Lunt, Soil Scientist at the Conn. Agr. Expt. Station, finds rates of 10 tons per acre better than 20 tons per acre. The writer confirms this observation based on his own experience. The reduced yields with heavier applications of sludge are believed to be the result of toxicity from too high concentration of the elements mentioned previously.

Yields of subsequent vegetable plantings on soil previously treated with sludge are not so retarded nor are late-season crops likely to be appreciably affected. Increased crop yields have been reported by many investigators after the first year, these increases often extending into the third year.

Yields are improved by sludge fortification with mineral fertilizers. It is often more practical to apply the sludge and then add mineral fertilizers.

Various formulae for nitrogen additions as well as phosphate and potash additions may be found in many references.*

Seed Germination

Connecticut tests by Lunt show delayed or reduced germination of bean, spinach, beet and lettuce seeds (the only ones tested) on soils recently treated with sludge. Practically speaking, this is not serious since seed applications are usually ample to insure a good stand.

STAMFORD, CONN., sells heat dried sludge to commercial fertilizer producer. Top photo shows bagging equipment and lower photo shows loaded bags ready for shipment.

Barging Sludge to Sea

While at first thought this practice might appear to be the waste of a natural resource, from the ecological viewpoint, it at least affords in a limited area utilization of the sludge as a food for fish and for the fertilizing of sea plants.

Trends in Sludge Use

W. S. Foster in American City magazine for December 1950 finds a growing trend in use of liquid sludge for orchards and vineyards. Care should be exercised in the use of liquid sludge, however, since even *digested* liquid sludge is likely to produce temporary odors of nuisance proportion as well as unsightly conditions upon application to lawns or gardens.

Foster also reports, as the result of a survey, upon sludge sale by the larger sewage treatment plants to brokers for blending of sludge in commercial fertilizers. In California liquid sludge is being fortified before use on orchards. There is a desirable trend in Connecticut of utilizing waste heat from refuse incinerators for the drying of digested sludge. The refuse incinerators are built adjacent to the sewage treatment plants and permit sludge drying to a point that economical use can be made of the sludge product for distant hauls exceeding the usual practical haul of 5 to 10 miles for moist sludge cake.

Grinding Digested Sludge

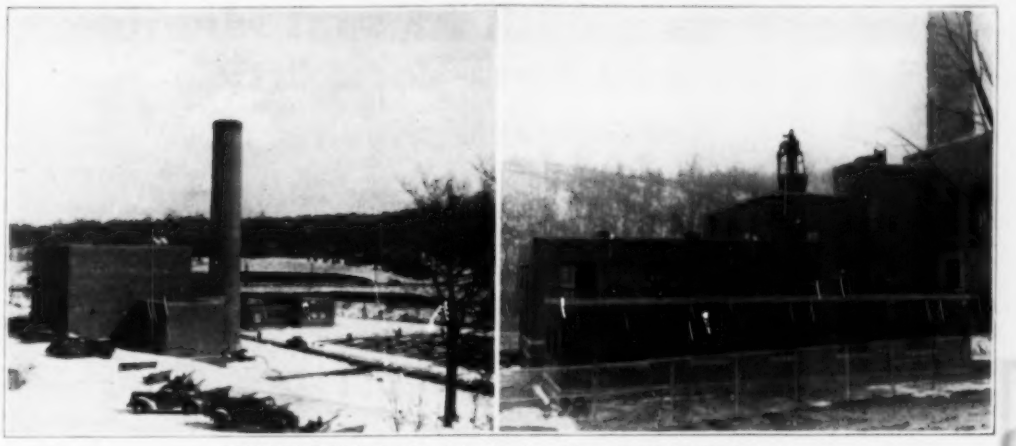
By shredding sludge to about pea size its salability is greatly enhanced. The author estimates that some 25,000 tons of digested sludge cake are currently available at Connecticut sewage treatment plants. Perhaps half of this production is finding its way back to the soil. Grinding would further increase its utilization in Connecticut and other states as indicated by the increased demand noted at the few plants where grinding is practised.

The Future of Sludge Utilization

In view of the dearth of farmyard manure and the need of many soils in the United States for humus, the outlook for sludge utilization should indeed be encouraging. Sewage works supervisors would do well to interest their local agricultural experts at State Agricultural Experiment Stations and follow their rec-

* The Conn. Agr. Expt. Station recently reported increased yield and value of tobacco crops to which 20 lbs. of copper as copper sulphate was added per acre.

* See for example: (1) Federation Manual of Practice No. 2, page 65. (2) "Increasing the Salability of Sludge" by P. N. Daniels, Water Works & Sewerage, August 1944. (3) "Sludge as Fertilizer in the War Emergency" by the author, Water Works & Sewerage, May 1943.



REFUSE INCINERATOR, adjacent to Waterbury, Conn., Sewage Treatment Plant
Waste heat from incinerator is used to dry raw, primary sludge. Portion of sludge dryer is visible on roof of vacuum filter building

ommendations. The author believes that many soil experts are not alive to this potential source of humus and have insufficient information concerning its nature and possible uses. A recommendation from such experts will go a long way in promoting the development of a sound program. The recommendations of State and local health departments should also be followed.

In the author's state significant information on sludge use was recently forwarded to sewage works supervisors in the form of a "Memorandum on Use of Sewage Sludge as a Soil Conditioner." (See box.)

It should be emphasized that sludge is not a balanced food for plants. Its application, however, has a mechanical effect on the soil, and improves its texture. The continued exclusive use of commercial fertilizer represents unsound and dangerous agricultural practice. Soils repeatedly planted to growing crops require the organic humus supplied by manures, peat moss, green cover crops or sludges. The value of sludge should not be judged by comparison of chemical analyses with artificial fertilizers, but *by the results it produces in plant growth.* Sir Albert Howard has stated in this respect:

"We seem to be always thinking in terms of soil nutrients. This is a great mistake. In agriculture it is a question of the utilization of fungous tissue mobilized in the form of humus which really matters and which is one of the secrets of the agriculture of the East. This fungous question is far more important than nutrients and in this matter we have gone on completely wrong lines."

It has been stated that we are what we eat. Crops grown on impoverished soils will be impoverished themselves and our health may suffer in turn.

A recent recommendation of the New Zealand Ministry of Works' Committee on "Utilization of Organic Wastes," states:

"The design of all future sewage treatment plants in this country should take full cognizance of the potential value of sludge as a fertilizer."

Whenever practicable, our own cities would do well to take like steps to utilize this valuable natural source of humus and other soil building elements.

State of Kansas Retains Howson, Veatch and Wolman

To Report on Water-Land Use and Flood Control in Kaw River Basin

Acting on orders of Gov. E. F. Arn to secure the "highest qualified specialists in the country" the Kansas Industrial Development Commission (Harry Stevens, Chairman) has retained L. R. Howson of Chicago, N. T. Veatch of Kansas City and Abel Wolman of Baltimore to prepare an independent report setting up a recommended program of land-water uses and flood control for the Kaw River Basin.

On Sunday, Sept. 21, these three nationally known engineers met with Governor Arn and Chairman Stevens of the KIDC where an agreement was reached on the understanding that Howson, Veatch and Wolman would cooperate in the preparation of "an objective and unbiased answer" to the controversial dispute on future plans for flood control and basin development which has followed the billion-dollar flood losses of 1951 created by the Kaw in flood.

The retention of the panel of three prominent sanitary and hydraulic engineers makes good news. We trust it will establish a precedent, wherein an independent expert appraisal is to be made of the various proposals made by state and federal agencies which would involve the expenditure of billions of dollars for flood control, basin developments and related projects in a river basin, involving disputes between federal agencies over jurisdiction, priority and financing.

The panel has set up a schedule which calls for a preliminary report only in 1952 and a final report not later than May 1953.

Television Affects Water Pressure

One of the noticeable effects of television is on the pressure in a city's water system, says Alfred G. Stevens of Manchester, N.H., a director of the National Association of Master Plumbers.

Plumbing contractors have observed, he reports, that water pressure in a city's mains is invariably highest when people are watching their favorite programs — and dishwashing and bathing are at a minimum.

Federation's 25th Annual Meeting Held in New York City

I—Program Highlights

Retiring President
Earnest Boyce

Incoming President
E. S. Chase

RECORDS were set at the meeting of the Federation of Sewage and Industrial Wastes Associations in New York City October 6-9, 1952. The registration—1145 members and guests—exceeded by 200 the highest previous attendance, at the 1950 meeting in Washington, D.C. It was fitting that the attendance, the technical program, and the social events at this meeting should be outstanding, for it was the Silver Anniversary of the Federation.

The record success of the entire affair was evidence of many individual and group contributions. Deserving of particular praise are the officers of the Federation, those in charge of meeting arrangements, and those responsible for the technical program.

Special credit should go to President Earnest Boyce and to Executive Secretary W. H. Wisely for planning and conducting a meeting in keeping with the position the Federation has earned among important scientific organizations of the world.

The convention management committee, W. J. Orchard, Chairman, and the local arrangements committee, George E. Symons, Chairman, earned recognition for accomplishing an exceptional job of organization.

A technical program of unusually broad interest was provided by the program committee (F. W. Gilcreas, Chairman, and Rolf Eliassen, Vice-Chairman) and by all those who contributed papers and took part in discussions.

The meeting included five technical sessions, an industrial wastes forum, and a plant operators' forum. These sessions will be reviewed in subsequent reports.

The Federation Board of Control held two business meetings and received the reports of various committees.

New Officers

The following officers will serve the Federation for the coming year:

President
E. Sherman Chase

Vice-President
Louis J. Fontenelli

Treasurer
W. W. DeBerard

Executive Secretary-Editor
W. H. Wisely

Advisory Editor
F. W. Mohlman

Honors and Awards

At the annual dinner of the Federation, the program included presentation of the 1952 FSIWA awards.

The HARRISON PRESCOTT EDDY MEDAL is awarded annually for outstanding research contributing to fundamental principles or processes of sewage treatment. This medal was awarded, for their paper on the hydraulic behavior of storm water inlets, published in the 1951 Journal, to:

Wen Hsiung Li
John C. Geyer
George S. Benton
Knut K. Sorteberg

The investigation reported by these authors was conducted at Johns Hopkins Univ., where Mr. Geyer is Assoc. Prof. of Civil Engineering.

Luncheon Speakers
Accomplishments
Chas. Emerson
Challenges
Abel Wolman

Vice-Pres. Elect
L. J. Fontenelli

Exec. Secy. Editor
W. H. Wisely

The GEORGE BRADLEY GASCOIGNE MEDAL is awarded in recognition of an outstanding contribution to the art of sewage treatment works operation. This medal was awarded, for his research on the effect of detergents on plant processes, published in the 1951 Journal, to:

Walter A. Sperry

Mr. Sperry is Superintendent of the Aurora Sanitary District, Aurora, Ill.

The CHARLES ALVIN EMERSON MEDAL is awarded in recognition of especially meritorious service to the Federation. For his long and faithful work as an organizer, for his service on many committees of the Federation, and for his numerous technical papers which contributed to the progress of the art of treatment, this medal was awarded to:

Frank Woodbury Jones

Mr. Jones is Consulting Engineer, Havens and Emerson, Cleveland, Ohio.

The INDUSTRIAL WASTES MEDAL is awarded for the most outstanding contribution by an industrial employee on an aspect of industrial wastes control. This medal was awarded, for their paper evaluating factors in the performance of oil sep-

Committee Chairmen
Management
W. J. Orchard
Arrangements
G. E. Symons

arators, published in the 1951 Journal, to:

R. N. Giles
F. W. Scheineman
C. T. Nicholson
R. J. Austin

These authors were employed on the technical staff of the Standard Oil Co. of Indiana.

A PAST PRESIDENT'S CERTIFICATE was presented to Ralph E. Fuhrman, 1950-51 President of the Federation, by the incoming President, E. Sherman Chase.

The PRESIDENT'S GAVEL was presented to President Chase by the retiring President, Earnest Boyce.

The VICE-PRESIDENT ELECT, Louis J. Fontenelli, Supervising Engineer of the Rahway Valley Joint Meeting, N. J., was introduced to the members of the Federation.

Bedell Award Winners

Once every three years, each member association of the Federation is privileged to name one of its members to receive the Arthur Sidney Bedell Award, which acknowledges extraordinary personal service. At this meeting, certificates were presented to eleven recipients and the actual award will be made to the following men at the next annual meeting of their respective associations:

D. E. Bloodgood, Central States
H. G. Baity, North Carolina
Paul Bolton, Iowa
P. N. Daniels, New Jersey
F. W. Kittrell, Kentucky-Tennessee
R. E. Koon, Pacific N.W.
W. S. Mahlie, Texas
C. T. Mudgett, Michigan
W. F. Freeborn, Institute of Sewage Purification (England)
Harrison Hale, Arkansas
G. A. Rhame, So. Carolina

Social Events

Entertainment was planned for two of the three evenings and one evening was left free for personal choice. On Monday evening a "Family Night" party featured outstanding variety show performers—song, dance, comedy, acrobatic, and magic acts—and concluded with a 75-voice glee club. The Federation dinner on Wednesday evening was followed by presentation of awards and then by dancing; this is the outstanding social event of the convention.

Ind. Wastes Medal
R. N. Giles

Eddy Medal
John Geyer

Gascoigne Medal
Walter Sperry

Emerson Medal
Frank Jones

Honors and Awards

Anniversary Luncheon

The Silver Anniversary Luncheon had at the head table many of the officers and directors of the Federation who had participated in its founding, and the program was presented by that group. The Toastmaster at the luncheon was W. J. (Bill) Orchard, who performed his function with the enthusiasm and humor that is characteristically his own.

Charles A. Emerson, original Chairman of the Federation, reviewed its accomplishments during the first quarter century of its life.

Abel Wolman, original Vice-Chairman of the Federation, commented on the challenges which lie ahead in the life of the Federation.

Chairman
F. W. Gilcreas

Vice-Chairman
Rolf Eliassen

Program Committee

Registration
C. R. Velzy

Finance
T. T. Quigley

Entertainment
J. J. Horgan

Manufacturers
J. G. Stewart

Committee Chairmen

Inspection Trip

On the last afternoon of the meeting, busses were provided for an inspection trip to the newly completed Owls Head Sewage Treatment Plant of New York City. This plant employs unusual methods of activated sludge treatment and includes other features making the visit worth while.

Ladies Entertainment

The Ladies Entertainment Committee, Mrs. Karl Mann, Chairman, provided not only a full program of excellently planned events but also helpful advice concerning points of interest, amusements, and shopping facilities in the world's largest city.

Monday morning was devoted to a tour of the United Nations Buildings and a Dutch Treat luncheon in the U.N. dining room. In the afternoon there was fashion show and tea held in the Charleston Gardens of B. Altman and Co. store as a contribution of the New York State Sewage and Industrial Wastes Association. On Tuesday there was a boat trip around Manhattan Island.

Manufacturers' Exhibits

The many manufacturers' exhibits offered a liberal education in the newest and best equipment available in the sewage and waste treatment field. Much of the value of a convention is derived from the opportunity to inspect these displays.

Federal Publications on Water Resources

"Water Resources — Irrigation, Drainage and Water Power" is the title of the latest price list of Government publications in this field. It lists available books and pamphlets on current topics, and gives the price of each.

Write to the Superintendent of Documents, Washington 25, D.C., for Price List 42, 40th Edition. There is no charge for the price list, a pamphlet of 17 pages.

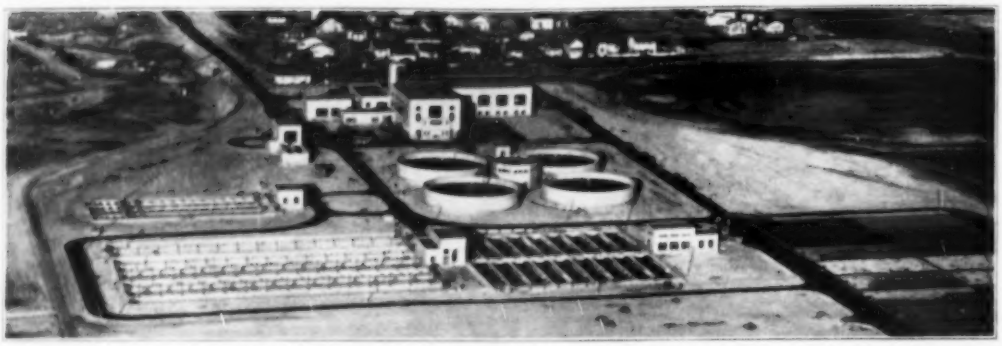


Fig. 1—AERIAL VIEW of treatment plant, Nassau County Sewage Disposal District No. 2

Supercharged Dual Fuel Engines at Nassau County Sewage Works

Flexible Diesel Units Operate on Oil or Sludge Gas Providing Electric Power and Compressed Air

by W. L. KAEHRLE, *Engine Specialist, Eastern Engine Div., Worthington Corp., New York, N.Y.*

WITH appropriate dedication ceremonies at Bay Park, East Rockaway, Long Island, on December 3, 1951, the sewage treatment works of Nassau County Sewage Disposal District No. 2 was officially placed in service. Serving the southwestern part of the County, it will handle sewage from various trunk-lines and laterals covering about one-half the county area and will serve approximately half of its population. It marks another step in the comprehensive program for treating of all sewage flowing into the surrounding waters of the Metropolitan New York area, a program which ultimately will remove the dangerous pollution reaching some recreational, bathing and boating sites.

Excluding the cost of several new trunk-line sewers and land, the treatment works in itself represents an investment of over $7,500,000, and is the first large modern plant in Nassau County and the first in the East using supercharged dual fuel engines to operate on sewage sludge gas for the production of all power required for its operation.

World War II and the unsettled conditions immediately thereafter (with resultant shortage of both labor and materials) caused a postponement of several years in carrying out the laying of the trunk-line sewers, their numerous laterals, and construction of the sewage treatment plant. It was not until the spring of 1949 that active construction began.

As far as the power plant was concerned, this postponement had a very favorable effect, for it was during this interval that intensive research on the part of several of the large engine builders resulted in development of four cycle, pilot ignition, dual fuel Diesel engines. These engines, as the name implies, burn both liquid and gaseous fuels, operate on the Diesel or high compression cycle, and use a small amount of liquid fuel (pilot oil) for ignition purposes. The operation of this type of engine has been widely publicized, and it will suffice to state here that this type engine when utilizing gaseous fuel operates on the highly efficient Diesel cycle with only a nominal increase in pressure after ignition (55 to 60 percent), compared with a large increase in pressure after ignition (250 to 275 percent) on a low compression spark ignition gas engine operating on the conventional Otto cycle.

Further developments and refinements continued, and in 1945 the application of supercharging to dual

ENGINE—Generator-Blower room

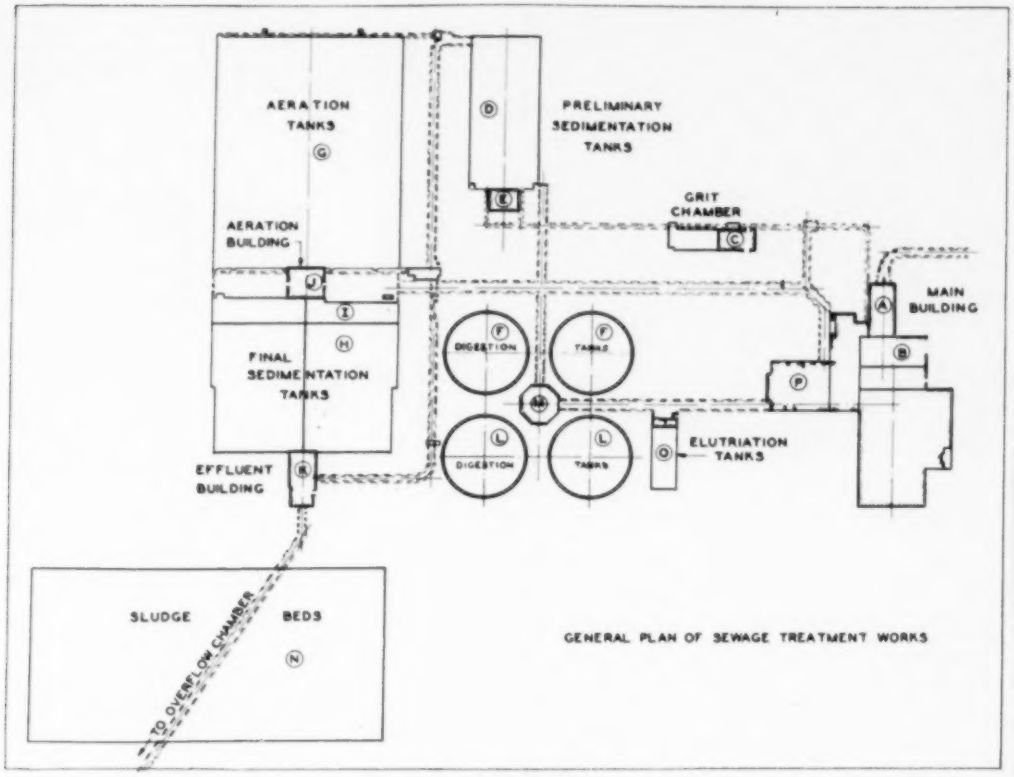
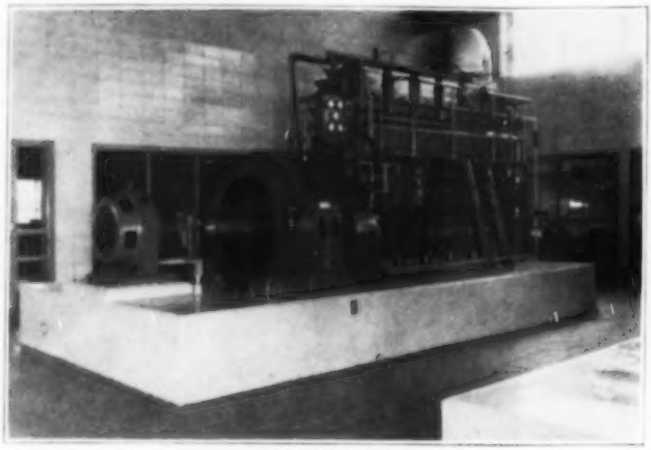


Fig. 2—FLOW DIAGRAM.
The letters indicate location of plant buildings and treatment units referred to in text.

fuel engines was successfully made so that this type of engine is being considered for all medium and large sized sewage treatment plants where sludge gas is available as a fuel supply. Here is an excellent application for this type of unit, since it can be used to furnish power just as soon as the plant is ready to be placed in service by operating entirely on fuel oil until the sludge gas is available (usually some 4 to 6 months after the initial operation of the sewage treatment plant); also, it eliminates the necessity of purchasing outside electrical energy with attendant demand charges during the period of initial operation until fuel gas is available from the digestion of the sewage sludge. Likewise, during such periods when there is a temporary deficiency of gas fuel, this can be balanced by increased amounts of fuel oil, even to the automatic change from maximum gas to 100 percent oil, should the supply of gas fail.

MAIN switch gear in electrical room

With the supercharged dual fuel engine further advantages are evident in higher mechanical efficiency, considerably better fuel consumption (averaging more than 29 per cent through an engine load range of 50 to 100 per cent), improved lube oil consumption (up to 22 per cent) when compared with the conventional four cycle low compression spark ignition engine of comparable horsepower and speed.



ENGINE—Generator Unit No. 1

Thus the enforced postponement in the construction of the project actually resulted in the availability of these ideal internal combustion engines for sewage treatment power plant application, and their subsequent installation in this modern plant.

On April 4, 1949 formal plans and specifications were issued for bids on the construction of this sewage treatment works, the work being divided into seven separate contracts. Awards were made shortly thereafter.

The Treatment Works

Before proceeding with the actual details of the power plant itself, a brief description of the overall project and its operation may prove interesting. All the New York City plants are located near waterways, so that the treated sewage effluent can easily be discharged through a suitable outfall. The location of this plant is no exception. When the plant is located on marshland at a shore or channel at sea level, the soil conditions usually necessitate the extensive use of piling for the support of building foundations. In this respect the County of Nassau is fortunate, since below a relatively thin layer of gray mud there is an excellent sand bed, making it possible to build all structures without resorting to piling.

In order to lower the ground water table some 17 to 27 feet below high water level and facilitate construction, a system of well-points was used. These well-points were connected to several discharge headers, and the system discharged approximately 15,000 gpm of water, this quantity varying with the rise and fall in tide and as the construction work progressed.

Fig. 1 gives an excellent air view of the plant site. The general plan, Fig. 2, shows the arrangement of the treatment structures, and indicates the location of the various buildings and facilities.

By gravity flow in several trunk-lines and tributary sewers the raw sewage enters the plant through an 84 in. diameter main trunk sewer. At the screen chamber (A) the sewage is diverted through sluice gates into two separate parallel inlet channels, each of which contains a mechanically cleaned vertical bar screen. It then passes to a gate chamber where, by means of sluice gates, the sewage flow can be diverted to any of the main sewage pump suctions. The main sewage pumps located in the pump room (B) of the main building then pump the sewage into a 48 in. diameter discharge line. The pump room contains two 15 mgd, one 20 mgd, and one 30 mgd pumps, all of the vertical motor operated centrifugal type, with space provided for a future pumping unit.

Treatment Units

From this 48 in. main discharge header the sewage flows through a venturi meter for measurement, and then to the grit chamber building (C). Here the velocity is reduced to 1 ft. per sec., so that in passing through the grit chambers sand and grit can settle out, yet retention of organic solids in the sewage is possible. The quantity of grit is small and can be used for fill or similar purposes.

From the grit chamber the sewage flows into the preliminary sedimentation tanks (D), which provide approximately one hour retention time. The scum and settled sludge is mechanically collected and pumped by sludge pumps in the sludge pumping station (E) to the digestion tanks (F). The settled sewage next enters aeration tanks (G), which have a five hour retention time. In these tanks air is introduced into the settled sewage through swing diffuser tubes. The applied air varies from .5 to 1.5 cu.ft. per gal. of sewage.

The aerated sewage then flows into the final sedimentation tanks (H), where it is retained for slightly over two hours. The settled sludge is in part returned to the aeration tanks (G) and in part delivered to thickening tanks (I), where it is concentrated for approximately four hours. From these tanks the thickened sludge is pumped to the digestion tanks (F) by pumps located in the aeration building (J).

The effluent is pumped from the thickening and final sedimentation tanks (H) to the effluent building (K), which also houses the effluent screens and chlorine feeding equipment. The screened and chlorinated effluent is then discharged through an outfall into the channel waters.

Sludge Digestion

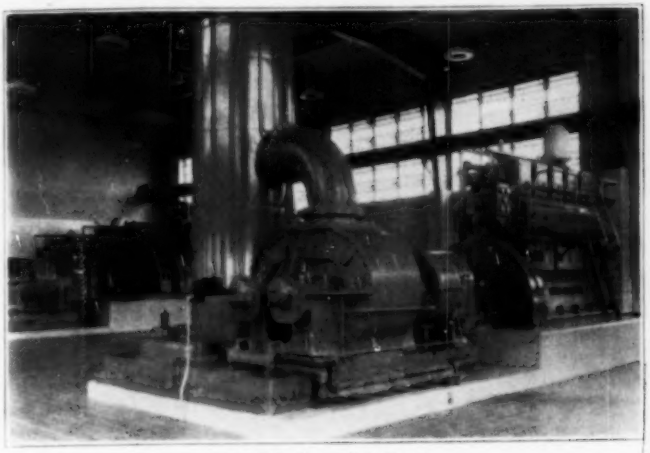
The collected sludge is digested in tanks (F) and (L). Pumps and other control equipment required to circulate and maintain desired temperature control are located in control building (M). Complete digestion requires from 20 to 30 days, at an average temperature of 85°F. Heat available from the dual fuel engine jackets is used to heat the sludge.

The sludge digesters are provided with floating covers and the gas generated is maintained at a few inches of water pressure above atmospheric pressure. The gas produced contains roughly 65 per cent methane (CH_4) with the balance principally carbon dioxide (CO_2). It is an excellent fuel for use in the dual fuel engines, no treatment being necessary, and it is expected sufficient quantities will be generated to supply a large part of the fuel requirements for the power plant. Any surplus gas can be used for fuel for building heating. To supply this gas at the required pressure for the engines, motor driven compressors are installed in the control building (M). These boost the gas pressure up to a maximum of 18 psi gage and deliver it to the gas pressure equalizing tanks located in the power plant basement in the main building.

The digested sludge, which contains approximately 90 per cent moisture, is pumped to sludge beds (N) for drying and subsequent use for fill. If it is desired to use the digested sludge for soil conditioning, it is pumped from the digestion tanks to

elutriation tanks (O), where it is washed to eliminate ammonia compounds which retard filtration and add to the conditioning cost. The elutriated sludge is conditioned by treating with ferric chloride and is dewatered on vacuum filters in the vacuum filter room (P) in the main building. The filters discharge sludge to a mechanical conveyor which can deposit it in trucks in the sludge loading room located directly beneath the vacuum filter room. The expected maximum daily output of filtered sludge is 45 cubic yards.

With the construction of some main trunks and laterals still under way, the sewage treatment works at present is handling approximately 10 mg of sewage daily. This flow is expected to approach 27 mgd in the near future, which represents the nominal capacity of the initial installation.



ENGINE—Blower Unit No. 5

Main Building

The generator and blower units are located in the main building, a two-story modern structure of light buff colored brick with green and red trim. The five Worthington dual fuel engine-generator and blower uits occupy a majority of the first floor space, the balance comprising the electrical control room with its main switchboard, blower and generator control equipment, main sewage pump control equipment, and main instrument panels; a modern machine shop; garage; sludge loading facilities; laboratory, lunch room and office and supply rooms.

The pump and the engine-generator-blower rooms both extend through the second floor as open areaways, the remaining space is occupied by the vacuum filter room and the air filter room. The latter space contains primary and secondary panel type filters, through which filtered air is carried down to a horizontal concrete air duct running beneath the basement floor, and from which the blowers receive their supply. Air for the engines is from a separate source, it being taken from a basement areaway extending along the building.

Basement Installations

The building basement contains the pump room where the four vertical motor driven raw sewage pumps are located, and a separate boiler room which furnishes heat for the various buildings. A major portion of the basement area is designated as the blower room basement, and it is there that all engine and blower auxiliary and accessory equipment is located. With a headroom of 15 ft., there is ample space for the waste heat boilers, blower air intake silencers, all tanks, etc., so that the main floor is kept clear of any unsightly runs of piping.

Since the basement was designed to provide high headroom, each engine foundation was not carried as a solid block to the basement floor. Rectangular openings, both longitudinal and transverse, are provided in each foundation block, the size of these cut-outs being such as to make a solid upper block of 6 ft. minimum depth, supported by several 3 ft. x 3 ft. square columns resting on a lower slab 2 ft. thick. All foundations are of reinforced concrete. The design gives adequate mass, ultmost rigidity, and yet provides additional free space in the individual blocks themselves for installation of several engine and blower auxiliaries. Each foundation block rests on the basement floor with a 2 in. thick layer of cork interposed. The floor itself is of reinforced concrete 2 ft. thick. This arrangement, possible because of existing soil conditions, eliminated the use of a water-tight seal, which would be required had it been necessary to extend the foundation blocks through the basement floor and support them on piles. They also are isolated from the main floor by a 1 in. air gap extending entirely around the blocks.

Engines, Generators, Blowers

To provide extreme flexibility and adequate standby service, since there are no outside connections for power supply, a total of five units is installed in the power plant. Two engines drive generators for furnishing power for all of the various electrically operated equipment in the various buildings, including the main vertical sewage pumps. Two engines drive positive displacement type blowers for supplying air required in the aeration tanks. One engine drives either a generator or a blower and thus can serve a dual purpose. When operating as an engine-blower unit, it drives the blower through the generator, the latter idling. The connection between generator and blower is by means of a flexible disconnecting coupling, which permits easy and quick disengagement when operating as a generating unit. For future plant expansion, space is allowed for the installation of another combined engine-generator-blower unit.

Designations, ratings and capacities of the foregoing units are as follows:

Unit No. 1—Worthington Model SCCGO-6 engine, rated 615 HP at 514 RPM, direct connected to an Electric Machinery 500 KVA, 400 KW at .8 P.F., engine type AC generator with a 7½ KW, 125 volt, direct connected exciter.

Unit No. 2—Worthington Model SCCGO-7 engine, rated 720 HP at 514 RPM, direct connected to an Electric Machinery 500 KVA, 400 KW at .8 engine type AC generator with a 7½ KW, 125 volt, direct connected exciter.

Unit No. 3—Worthington Model SDDGO-6 engine, rated 790 HP at 360 RPM, direct connected to an Electric Machinery 625 KVA, 500 KW at .8 P.F., engine type AC generator with a 15 KW, 125 volt, 1150 RPM, Multi-V-Belt driven exciter, and connected by a special Falk Steelflex flexible coupling to a Roots-Connersville 32 x 35½ Type RCDH blower having a capacity of 16,000 CFM.

Unit No. 4—This is to be a future unit similar to Unit No. 3 above.

Unit No. 5—Worthington Model SCCGO-5 engine, rated 400 HP at 403 RPM, direct connected through U. S. Rubber flexible coupling to a Roots-Connersville 26 x 27½ Type RCDH blower having a capacity of 8,500 CFM.

Unit No. 6—This unit is an exact duplicate of Unit No. 5 above.

All engines are of the supercharged four cycle dual fuel type designed to operate on approximately 94 per cent sewage sludge gas and 6 per cent pilot oil, or any proportions of gas and oil fuels up to 100 per cent fuel oil. They are equipped with hydraulic relay type governors having motor operated speed changing devices with control switches mounted on the main control benchboard in the electrical room. From that point the electrical generating units can be synchronized and the air output of the blower units controlled by speed variation to meet specific air requirements.

Adequate safety devices are provided so that each engine is protected against overspeed, low jacket water and lubricating oil pressure, and excessive water and oil temperatures. Should any of these faults occur, an electric horn is sounded and simultaneously all fuel is shut off to that engine by means of solenoid operated valves installed in the gas and oil supply lines of the engine. Visual signal lights for oil circuits and the audible signal horn are installed in the individual engine alarm boards located near their respective engines.

On engine overspeed a mechanical trip actuated by a spring loaded plunger in the flywheel instantly releases a shut-down operating mechanism, which operates directly on the governor fuel linkage to shut off all fuel to the engine cylinders and stop the unit immediately. A manual lever is used to reset the control whenever the overspeed trip functions. A plugging switch driven by gearing from the engine camshaft gear automatically makes the alarm system inoperative when the engine is shut down and during starting until an engine speed of approximately 20 per cent of rated speed is reached.

An electric tachometer is provided for each engine, the tachometer generator drive being similar to that for the plugging switch.

The location of these various devices is shown on the close-up view of the engine control, Fig. 3.

Pyrometer equipment for indicating individual cylinder exhaust temperatures, the exhaust gas inlet to and outlet temperature from the turbocharger, and also the exhaust gas temperature from the boiler-silencer, is installed for each engine. The pyrometer and tachometer speed indicating instruments are both installed on the engine alarm panel boards.

Engine Design Features

There are numerous design features found on these supercharged dual fuel engines of which the following are worthy of special mention—(1) individual dual plunger fuel injection pumps; (2) automatic thermal air throttling control; (3) micrometering gas valves; and (4) dual fuel control—all of which contribute to better operating performance and maximum fuel economy.

Dual Plunger Pumps

Since all dual fuel engines require a small amount of pilot or ignition oil when operating on gaseous fuels, provision must be made to accurately meter and inject this pilot oil into the mixture of air and gas in the engine cylinder near the top of the compression stroke; provision must also be made for accurately metering and injecting the total quantity of oil required when the engine operates entirely on liquid fuel. On most engines of this type it is accomplished by two separate sets of fuel pumps—one set for the pilot oil and another for the main fuel oil. That is not the case with these Worthington engines, as both functions are performed by one pump, cross-sectional view of which is shown in Fig. 4.

The pump is essentially two pumps in one casing. There is a small diameter pilot plunger mounted non-rigidly on the top of the main plunger and actuated by it. The plunger assembly is actuated by the fuel injection cam on the camshaft through its full travel. This pump also has two delivery or discharge valves—one for the pilot plunger; the other for the main plunger.

The suction of the fuel injection pump is taken through intake ports in

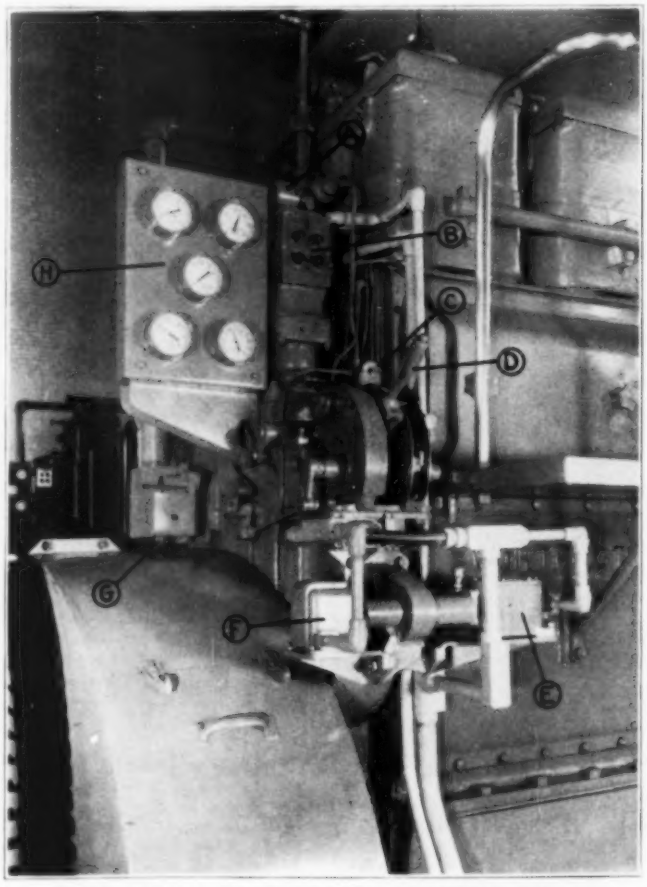


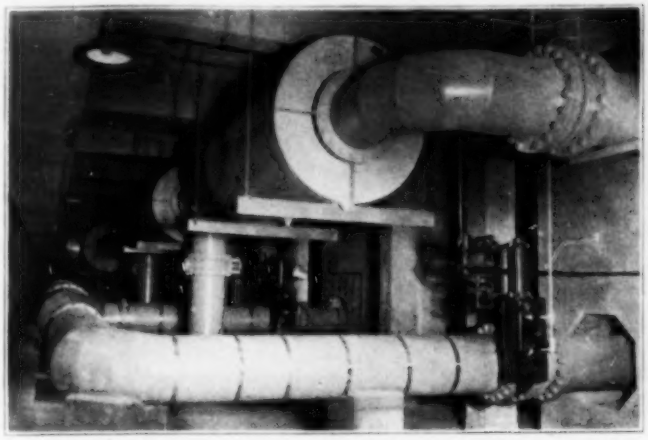
Fig. 3—OPERATING CONTROL of Unit No. 2 Engine-Generator
Legend: A—Governor synchronizing motor; B—Governor; C—Selector valve (thermal air control); D—Main control lever; E—Tachometer generator; F—Plugging switch; G—Engine overspeed trip lever; H—Gage board.

the pump barrel from the fuel oil manifold, which ports are uncovered by the plungers at the bottom of their stroke. Fuel oil is continually bypassed around the pump barrel for cooling.

The amount of fuel delivered by the main plunger is regulated by rotating the pump plunger by means of the control rack, so that the helical groove uncovers the ports at different points in the plunger stroke. Rotation of the plunger is controlled by the governor. The pilot injection quantity is determined by the distance from the top end of the pilot plunger to the circumferential groove on the plunger.

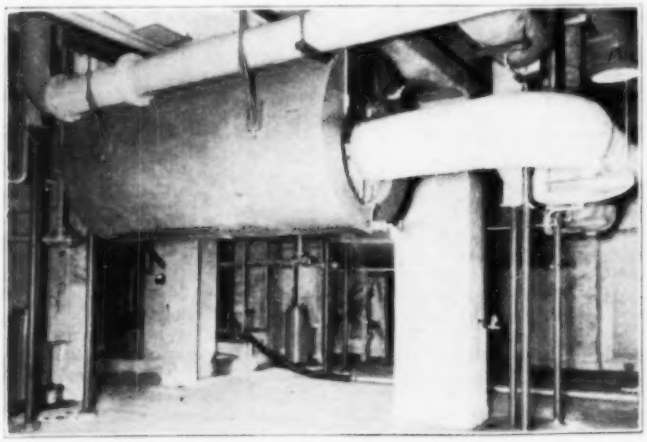
When operating the unit on fuel oil only, the governor will actuate the main fuel pump racks to deliver the quantity of fuel required by the load. The total fuel oil used will be a total of the constant full stroke capacity of the pilot plunger plus the additional fuel oil delivered by the main plunger. In other words, the fuel oil delivered represents the displacement of the pilot area plus the annular area between the pilot and main plunger diameters over the full pilot plunger stroke.

When operating the unit on fuel gas only, the main rack position is at zero and the only fuel oil delivered is the quantity delivered by the pilot plunger. During the upward stroke of the pilot plunger, the fuel oil is bypassed back to the suction side of the system until the pilot plunger closes the drilled port passageway, after which fuel oil is discharged through the delivery valve until the port is uncovered by the upper edge of the circumferential groove. The delivery valve then returns to its seat, and the excess fuel oil is bypassed through the drilled passages in the pilot plunger back to the suction ports. Incidentally, the capacity of the pilot plunger is less than the amount of fuel required to maintain rated engine speed at no load.



SILENCERS in blower air inlet lines and automatic control valves in blower air discharge lines

Several advantages result from the use of these individual dual plunger pumps: (a) a single fuel oil injection nozzle or spray valve for each engine cylinder can be used both for gas and fuel oil operation; (b) instantaneous as well as smooth operation is assured when going from gaseous to liquid fuels; (c) due to the small diameter of the pilot plunger, the pilot oil is injected over a relatively long period, producing localized penetration into the cylinder combustion space, which contributes to smooth combustion. The latter characteristic retards detonation, actually resulting in quieter operation with reduced firing pressures and lower exhaust temperatures.



MAXIM waste heat boiler-silencer in engine exhaust line

Automatic Thermal Air Throttling Control

This control is shown in Fig. 5. As the name implies, it provides a means of reducing the air supply to the engine at reduced engine loads, a very important factor for efficient operation of a supercharged dual fuel engine. On a supercharged Diesel engine the air intake is designed and proportioned to permit a maximum of air flow into the cylinders for best combustion. At full load, as well as at partial loads (within certain limitations) fuel economy is improved as the air supply is increased. Extensive research has indicated that when operating such an engine as a dual fuel engine, optimum fuel economy is obtained at full load as the air-fuel ratio is proportioned properly for most efficient combustion, but at loads less than full load the air supply is greater than required.

It has been determined that for best engine performance the exhaust temperature of a supercharged dual fuel engine should be maintained at within a variation of 50°F from a constant mean as engine load is reduced. The thermal air control makes use of this characteristic. To throttle and provide the proper air supply at reduced loads, an air control or butterfly valve is installed in the air intake line adjacent to the engine air intake manifold. This butterfly valve is positioned, as the load changes, through linkage by an air operated diaphragm motor and positioner, which is in turn actuated by an automatic temperature controller.

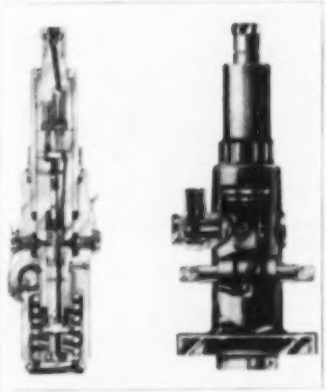


Fig. 4—DUAL PLUNGER fuel pump

When the engines are operating on gaseous fuel, the temperature element will indicate a temperature of approximately 700 to 750°F at nominal full load engine rating, and with a fully open air control valve. The controller is set to fully open the air control valve at 700°F, selected to correspond to this nominal full load exhaust temperature. The air supply for the controller and positioner is obtained by reducing the normal air pressure in the starting air system. A 17 psi gage air pressue, applied to the diaphragm motor, positions the air control valve in its maximum throttling position. With no presure on the diaphragm motor the air control valve will be in a full open position.

The engines are started on fuel oil, then switched to gas operation, at which time the air control valve is in the closed position, and it remains there until the load causes the exhaust temperature to reach a predetermined point, when (acting through the controller, air positioner and diaphragm motor) it will reposition the air control valve to maintain the proper air-fuel ratio. This selection and automatic positioning of the air control valve varies continually with load changes, thus maintaining the best air-fuel ratio at all times.

When operating these engines as supercharged Diesel engines solely on fuel oil, it is not necessary to throttle the air under any load condition. Therefore, a 3-way or selector valve is installed in the controlled air supply to the air operated positioner, so that when operating on fuel oil only it is possible to exhaust the air from the system and make the control inoperative. With no air pressure on the diaphragm valve the air control valve is held in full open position.

The purpose of the safety device and 2-way valve in the air pressure supply line to the diaphragm motor is to prevent any over-throttling of the intake air to the engine which might be caused by failure of instrument air in the controller, or by very sudden and rapid increase of load on the engine.

While various methods are used by different engine builders to provide for air throttling control in supercharged dual fuel engines, Worthington is the first manufacturer to utilize engine exhaust temperature to actuate this control. Thus it is possible to obtain a correct air-fuel ratio to all engine cylinders at all times and in direct relation to all load changes.

Micrometering Gas Valves

These engines have individual gas metering valves for controlling the gas fuel supplied to each cylinder. Individual valves, under direct control of the engine governors, are a necessity if any semblance of balance is to be maintained between cylinders throughout the load range.

They are a balanced plug type valve having very accurately milled flats of suitable taper. The shape of these flats provide a varying orifice which allows for exact metering of the gas to maintain correct air-gas ratios even at partial loads. This results in smooth operation at light loads, which heretofore has been very difficult with gas engines.

The valves have light frictional resistance. Their compact design permits location very close to the cylinder heads; thus, no large volume of gas is contained between the valve and the timing valve to slow the response of the engine cylinders to load changes.

Dual Fuel Control

The control for these engines is shown in Fig. 3, and the sequence of operation can be followed from the graduated quadrant on the right side of the control lever. With the lever in the STOP position at the bottom of the quadrant, all fuel, both gas and oil, is shut off. Movement of this lever slowly through the range marked OIL to the position marked RUN will start the engine and operate it entirely on fuel oil. This is the regular setting for operation entirely on fuel oil. If operation on gas is desired, the control lever is moved upward through a range marked GAS. In the extreme top position of the quadrant the engine is operating on maximum gas, that is, 94 per cent gas and 6 per cent fuel oil. With the lever positioned at any intermediate graduations, the engine will operate with the designated proportions of these fuels as indicated on the quadrant band.

When starting up and shutting down an engine, operators are instructed to operate for several minutes on fuel oil, as a check to insure that the engine is functioning properly as a straight Diesel engine.

If at any time the amount of sludge gas available to any engine diminishes below the quantity selected, the control lever is moved manually to meet the load demand. The speed of the engine at all times is under control of the engine governor, and all changes in fuel or proportions of sludge gas and fuel oil are accomplished without any dropping of engine load and without affecting its speed.

Except for a few safety devices which operate on 125 volt DC current, the power plant uses 440 volt, 3 phase, 60 cycle, AC current for all motor driven auxiliary and electrical equipment and, therefore, power generation of the engine-generator units is at 460 volts.

While the rated air output of the engine-blower units is based on 8 psi gage discharge pressure with an air inlet temperature of 60°F, they are required to operate throughout a range of discharge pressure from 6.25 to 8.25 psi gage, and with air inlet temperatures varying from a winter low of 20°F to a summer high of 100°F.

Engine-blower units No. 5 and No. 6 at this plant have 20 in. inlet lines connecting to the main air duct; a lever operated butterfly type valve and an intake silencer is installed in each inlet line. Air connection to each blower is through the blower baseplate. The air intake for engine-generator-blower unit No. 3 is similar, except that the line is of 30 in. diameter.

Installation photographs show the arrangement of the blower air discharge lines, each with its large air silencer set vertically on the blower baseplate. The connection between the silencer and blower discharge is by means of a long-sweep 90° pipe bend. Incorporated in the blower baseplate are two manually operated valves, one a pressure relief valve to prevent overloading and capable of discharging the full capacity of the blower; the other a bypass unloading valve to permit starting up of the unit without load. There is also installed in each blower discharge line, prior to its connection with the discharge air main, an automatic hydraulic cylinder operated valve. Operation is controlled by water pressure in such a manner that when the pressure from the blower exceeds the pressure in the discharge air main by more than

.5 psi, the valve will open and be kept open by the differential in pressure due to the velocity head. When the engine-blower unit is shut down the pressure drops and the valve closes.

Unit No. 3 has a 24 in. discharge line, while the smaller units No. 5 and No. 6 each has 20 in. lines. All discharge lines, as well as the connections to the blowers, are provided with spool type expansion joints. The discharged air is delivered to the aeration tanks in a 42 in. diameter main.

Air Intake System

Each of the five dual fuel engines takes air from an areaway which runs along the side of the basement wall. Individual filter panels of the viscous impingement type are mounted in frames set in openings in this wall. Weather louvres also are provided. The individual air intake lines, with a flared inlet connection to the filter frame, run horizontally beneath the basement ceiling to a vertical riser extending, through the grated opening in the main floor, to the turbocharger inlet on each engine. A flexible metal pipe connection is installed in the risers.

Exhaust System

Each engine is equipped with a Maxim combination waste heat boiler and exhaust gas silencer, designed for generating low pressure steam. The silencers are installed in a horizontal position and are supported by pipe hangers suspended from the basement ceiling.

These boiler-silencers are designed to operate dry with an exhaust temperature of 800°F, and also to generate steam at 5 psi gage with a feedwater inlet temperature of 160°F. All steam generated goes into the low pressure steam heating system of the plant. The exhaust gases leaving these boilers always are maintained above 300°F to prevent condensation which would occur should they reach the dewpoint, and cause a corrosive action by the sulphur present in the gases. The units are equipped with the usual accessories, consisting of thermometers, pressure gauge, level glass gauge, safety valve, blow-down valve, steam stop check valve, feedwater check valve, and pyrometer and thermocouple on the gas outlet. In addition, they are equipped with alarm devices for indicating high steam pressure and high and low water level.

The exhaust lines leaving the boiler-silencers run horizontally beneath the basement ceiling over to two vertical rectagular flues carried to the top of the building. Lines are grouped so that one flue serves Units No. 1, 2 and 3 and the other serves Units No. 5 and 6, with provision for the future Unit No. 4. The individual exhaust lines extend the entire length of the flue and discharge to atmosphere. They also are supported by means of removable guide rings around the pipes, which are welded to a channel frame anchored at the top of the flue, a design which permits vertical expansion of the pipes. Long-sweep foot elbows are used where the exhaust lines are led up into the flue, and these are supported on vertical pipe supports set on the basement floor.

All exhaust lines are covered by a 3 in. thick pipe covering, while a 4 in. thick insulation covers the waste heat boiler-silencers. Flexible metal pipe connections also are installed in the vertical run of the exhaust line leading from the engine turbocharger down to the boiler-silencers.

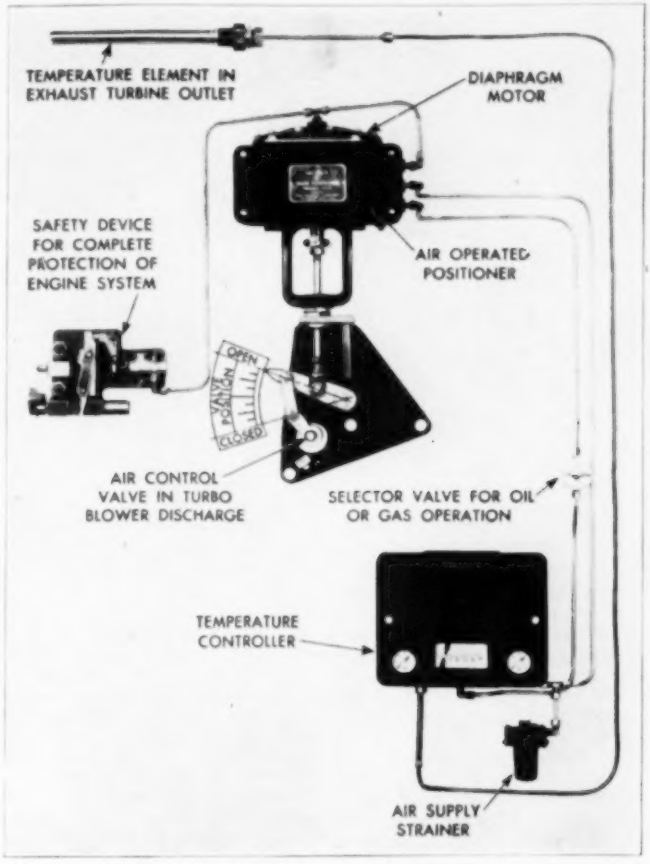


Fig. 5—AUTOMATIC thermal air throttling control

Fuel Oil System

Fuel oil for the engines is delivered by truck to the plant and stored in a 10,000 gal. underground tank located immediately adjacent to the engine-blower room wall. Duplicate motor driven rotary gear type pumps, each having a capacity of 10 gpm, transfer the oil through a 1 in. header to the individual day tanks supported by angle brackets on the side of each foundation block. In addition to these motor driven pumps, a 10 gpm hand operated transfer pump is installed for emergency use and also to provide for the initial filling of the day tanks. A disc type fuel oil meter and an edge type filter are installed in the header to register and filter the flow to the day tanks. An overflow line from each tank connects to a 2 in. return line to return any excess oil pumped into them. Remote reading level indicators conveniently located on the basement

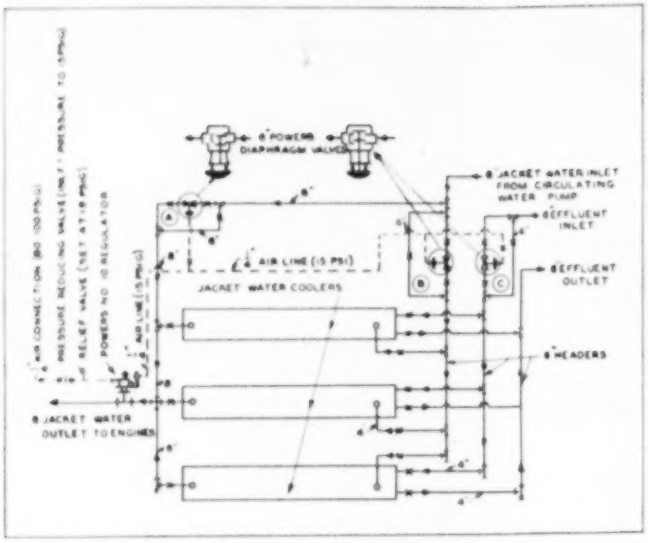

6" POWERS DIAPHRAGM VALVES
6" JACKET WATER INLET FROM CIRCULATING WATER PUMP
6" EFFLUENT INLET
6" EFFLUENT OUTLET
6" HEADERS
4" AIR LINE (5 PSI)
JACKET WATER COOLERS
6" JACKET WATER OUTLET TO ENGINES
POWERS NO 10 REGULATOR

Fig. 6—DIAGRAM of jacket water temperature control

wall record the contents of each day tank and of the storage tank.

An attached fuel oil service pump on each engine supplies oil from the day tank to the fuel oil inlet header on the engine, maintaining at all times a pressure of 25 psi gage to the dual plunger fuel injection pumps. Since these service pumps supply more oil than is required by the engines, the excess is bypassed through a relief valve back to the suction side of the pump. A duplex filter is installed between the service pump and fuel inlet header.

Fuel Gas System

The gas produced in the sludge digestion tanks is pumped by motor driven compressors of the rotary sliding vane type, located in the control building, to the engine-blower room basement through a 6 in. line and is delivered at a pressure of approximately 17 psi gage. After passing through a master meter, the gas moves through a header to individual gas pressure equalizing tanks set in the open space in the foundation block of each engine. Fittings are provided in the lines to each tank for connecting a portable gas meter to record the gas consumption of any particular engine, if desired.

From the pressure equalizing tanks the gas is piped to a diaphragm type pressure regulator and thence to a gas receiver on the engine. The function of the regulator is to maintain a uniform gas pressure of 15 psi gage, and that of the receiver is to provide an ample supply of gas to the engine at varying loads. This receiver is connected to the fuel gas manifold, which is mounted longitudinally along the exhaust side of the engine at its top. Separate branch lines leading from this manifold bring the gas to the individual fuel gas metering valves mounted on each cylinder head. These valves are operated by control shafts through suitable governor linkage and can be adjusted individually to provide an equal flow of gas to each cylinder. Gas is injected into the cylinder combustion space by fuel gas timing or injection valves operated from the engine camshaft.

To arrest and stop flame propagation in the event of a back-fire, a flame trap assembly is installed in individual gas supply lines leading from the pressure equalizing tanks to the engine. The assembly consists of a flame trap with arrestor grid, and a thermal operated shut-off valve with fusible element set to melt at 200°F and cause the valve to close—thereby shutting off gas flow to the engine.

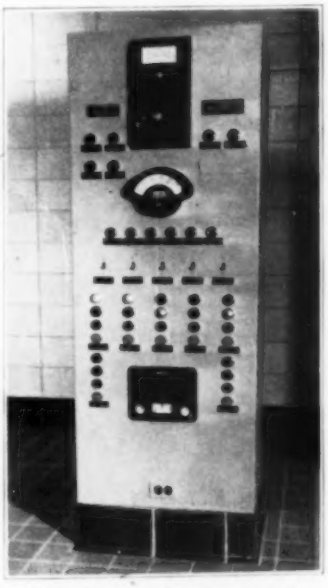
Starting Air System

A conventional starting air system comprising multiple tanks and compressors is installed in the engine-blower room basement. Four 36 in. diameter x 90 in. vertical ASME Code tanks are connected to a 1½ in. discharge header, which has individual branches leading up to the engines. Each air tank is equipped with regular accessories consisting of inlet and outlet valves, pressure relief valve, pressure gage, drain valve and check valve. Tanks are filled by duplicate motor driven air cooled compressors, each having a capacity of 16.6 cfm free air at 250 psi gage, and the system is equipped with automatic start and stop pressure control to maintain tank pressure between limits of 205 and 250 psi. Scale traps are installed in the individual lines to each engine, and moisture separators are provided in each air compressor discharge line to the air tanks and in the outlet lines from the tanks to the engines.

A separate compressed air system is provided for the plant, and the engine starting air system is connected to it through a pressure reducing valve; in an emergency the engine starting air system can be used to supply compressed air requirements.

Lubricating Oil System

The engines each have an individual self-contained lubricating oil system, consisting essentially of sump, circulating pump, filters and oil cooler. The lower part of the engine base forms the lube oil sump, from which an attached rotary gear type pump driven from the end of the crankshaft takes its suction. Oil is circulated by the pump through twin edge type filters to the shell and tube type lubricating oil cooler, then to the oil manifold in the engine base and also to various branches from which all internal engine parts are lubricated. This is a pressure type system, oil being supplied at a normal working pressure of 40 psi gage.



ENGINE alarm and instrument panel

To protect the system from excessive starting pressures when the oil is cold, a relief valve, set to open at 75 psi, is installed on the discharge side of the oil circulating pump and is piped back to the suction side. Also, to insure that the engine receives an ample supply of oil when started up and the oil is cold, a bypass relief valve, set to open automatically at a differential pressure of 15 psi, is installed to bypass the oil cooler. It closes automatically once the oil has reached the running temperature, permitting oil to follow its normal path of flow through the cooler.

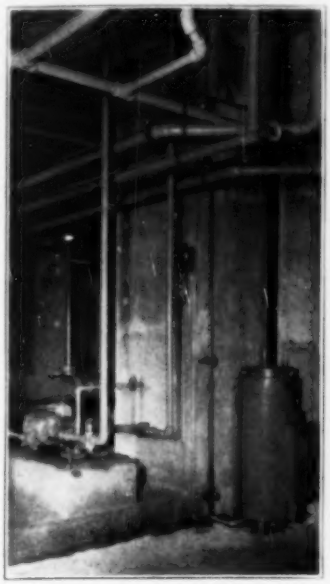
Each engine also has an auxiliary motor driven lubricating oil pump, so that lubricating oil can be supplied to the engine prior to starting and for cooling after the unit is shut down. The controls for this pump are installed in the engine alarm board located adjacent to the engines on the main floor, so that the pump can be placed in service from that point.

A lubricating oil purifier of the Fuller's earth type, having automatic heat control, is installed on a bypass in the main oil system of each engine. This bypass line is equipped with an orifice to provide a continuous circulation of oil through the filter, after which it is returned to the engine oil sump.

Each engine turbocharger also has a completely self-contained lubricating oil system, consisting of rotary gear type circulating pump, filter, finned cooling tube and reservoir. A normal pressure of about 15 psi is maintained.

The main air blowers likewise have a separate lubricating oil system. From an oil sump, located in the blower base, oil is circulated by a rotary gear type pump driven from the blower shaft through a shell and tube type cooler to sight feed oilers installed at each bearing and the timing gears. From these bearings and gears the oil is returned to the sump by gravity. A pressure of 15 psi is maintained in the sight feed oilers.

All engines and blowers have a central system of oil supply, draining, storage and treatment, grouped near one of the basement walls. The system consists of two 42 in. diameter x 96 in. vertical cylindrical storage tanks; duplicate motor driven rotary gear type transfer pumps each of 10 gpm capacity; a 50-100 gph oil reclaimer. The oil reclaimer includes a filter, vaporizer, vacuum pump, distillate tank, heat exchanger and pumps; a 48 in. x 36 in. x 48 in. clean oil tank; a dirty oil tank of the same dimensions; a 100 gal. waste oil sump;



AUXILIARY lube oil circulating pump

and a 10 gpm hand operated waste oil pump.

Through a system of valving, in which 3 way-2 port and 3 way-3 port 90° turn valves are used, lubricating oil can be delivered by the transfer pump to various points: (1) take oil from the storage tanks and deliver it directly through a 1 in. supply header to engine and blower sumps; (2) take oil from the clean oil tank and deliver to any engine or blower sump; (3) take oil from the storage tanks and deliver it to the clean oil tank.

Through a similar valve arrangement, the oil reclaimer is connected so that its pumps can take oil from the main storage tanks, the dirty oil tank, or directly from any engine or blower sump. The oil is conditioned and returned either to the clean oil tank or to engine or blower sump.

Individual drain lines from the engines and blowers are connected to a common 1½ in. drain header, where oil can flow by gravity either to the dirty oil tank or to the oil reclaimer. All oil tanks have drain lines connected to a 1½ in. waste oil header leading to the waste oil sump; the waste oil hand pump will deliver the discarded oil to a valved hose connection outside the building.

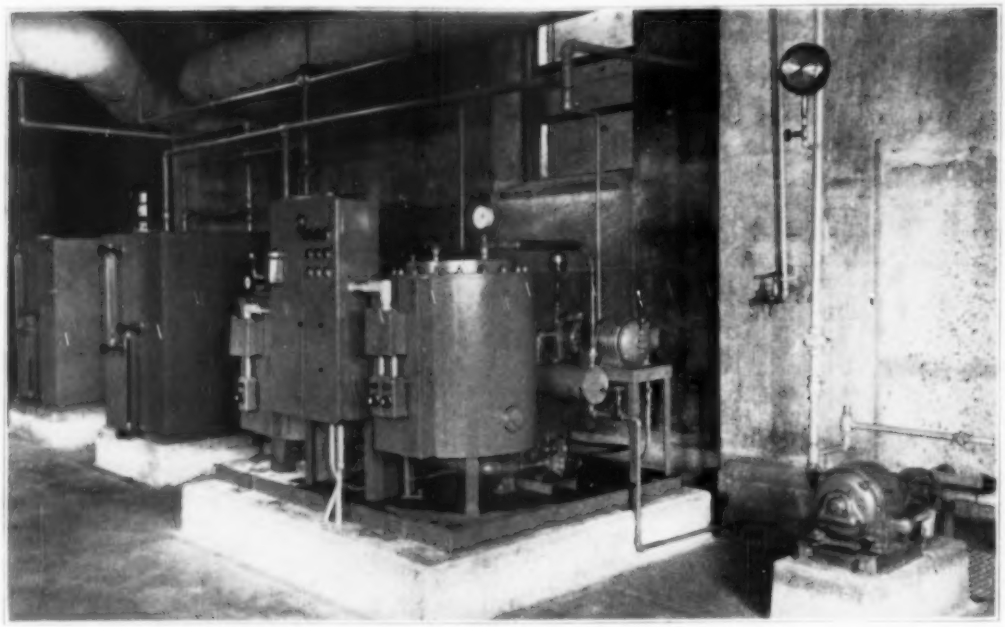
Vent and overflow lines from all tanks lead to an areaway outside the building. Also a basket type strainer is installed in the outlet of each storage tank leading to the transfer pumps. All oil tanks are provided with three ¼ in. test cocks for withdrawing small quantities of oil for sampling and analysis. The two oil storage tanks are equipped with liquid level gages to indicate the contents in gallons, and both the clean and dirty oil tanks have level sight glasses.

Jacket Water System

Heat from the engine jackets and also from the lube oil coolers is used for heating sludge in the digestion tanks, the interchange being through four shell and tube type sludge heat exchangers. The jacket water outlet lines from each engine are connected to a common 8 in. discharge header leading to the sludge heat exchangers installed in the control building (M). Through suitable valving and thermal control a portion of the engine jacket water can be diverted, when required, through three sludge water heater converters located in the vacuum filter basement in the main building. Here additional heat, if needed, is added to the engine jacket water from the low pressure steam heating system of the plant before it is circulated through the sludge heat exchangers.

Since heat requirements for the digester coils vary appreciably, supplemental cooling of the jacket water is necessary at times to maintain a proper inlet temperature to the engines. For this purpose three jacket water coolers are installed in the blower room basement. They are of identical size, each being capable of handling a heat load of 1,800,000 BTU per hr., and of cooling 225 gpm of jacket water through a 16 degree range with an inlet temperature of 132°F. Their combined capacity is such that they can handle the entire jacket water cooling requirements of the power plant, a condition which might occur during extremely warm weather in the summer, when heat requirements in the sludge digestion system are nil. Treated sewage effluent, at 70°F inlet temperature, is used for cooling the jacket water in these exchangers. Space is provided for future installation of a fourth jacket water cooler.

Circulation of jacket water is provided by means of four motor driven circulating water pumps installed in the blower room basement. These are of the horizontal, single stage, centrifugal type having end suction and top discharge. Two of the pumps have a capacity of 125 gpm each, and the other two of 175 gpm each, when pumping against a total dynamic head of 60 ft., thus giving flexibility to the system.



LUBRICATING oil storage and treatment equipment

The arrangement of equipment in jacket water circulation is seen when tracing the normal path of water flow in the system. The jacket water circulating pumps take their suction from a common header connected to the main return line from the sludge heat exchanger. These pumps circulate the water through the jacket water coolers, which are manifolded to common inlet and outlet headers of the individual water inlet lines to the engines. The individual engine lube oil coolers are installed in each of these inlet lines, so that all jacket water first passes its respective cooler before entering the jacket water inlet header on the engine. After circulating through the engine jackets, cylinder heads, exhaust manifold and turbocharger jackets, the water flows from the outlet connection on the engines to a common discharge header leading to the sludge heaters, thus making a closed circuit. To provide for expansion and venting of the system, an expansion tank with vent and overflow to a basement areaway is installed on a looped bypass between the common discharge header from the engines and the supply header to the circulating pumps.

The small amount of water required by the blower lube oil coolers is supplied by connecting them with a 1 in. line from the inlet side of their respective engine lubricating oil cooler. A 1 in. outlet connection to the common discharge header from the engines completes the circuit.

Since the engines operate under varying load conditions, and since the heat requirements of the sludge digestion system are not constant, a means of water temperature control for the jacket water system is necessary. This is provided at the jacket water coolers as shown by schematic diagram Fig. 6. It consists essentially of a Powers No. 10 Regulator mounted on a tee in the jacket water outlet line of the coolers with its thermostatic bulb directly in the path of flow, and three 6 in. Powers diaphragm valves installed in the following circuits:

Valve (A) in the jacket water return bypass of the jacket water coolers.

Valve (B) in the jacket water return to jacket water coolers.

Valve (C) in the effluent water line to the jacket water coolers.

The No. 10 regulator, which is of the direct acting type, has a manual temperature range adjustment between the limits of 70° F. and 170° F. By means of a movable pointer on the dial of the regulator, the desired water inlet temperature to the engines is set manually. Compressed air at 80-100 psi gage inlet pressure, reduced to 15 psi gage is the actuating medium for the diaphragm valves. These valves are of the balanced, double seat type with rubber diaphragm and adjustable springs.

Valve (A) is direct acting, while valves (B) and (C) both are reverse acting, so that when the water temperature rises to that of the regular setting, air pressure passes to the diaphragms of the valves, closing (A) and opening (B) and (C). When the water temprature falls to the set temperature, air pressure is shut off from the diaphragms of the valves, whereupon the springs act, opening (A) and closing (B) and (C).

Acknowledgement

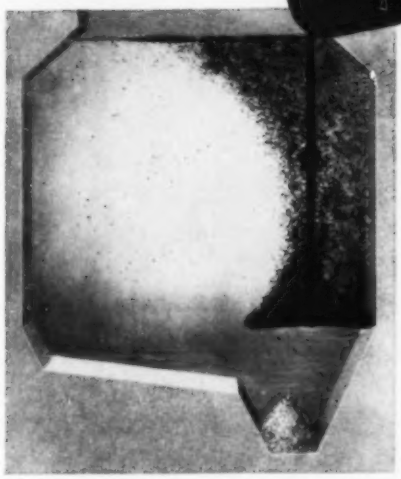
The entire sewage treatment works project was under the jurisdiction of the Department of Public Works of the County of Nassau, headed by John C. Guibert, Commissioner, and Harold Sherman, Deputy Commissioner of Sanitation.

All design, engineering and construction was under the direct supervision of Greeley & Hansen, Consulting Engineers, with Paul E. Langdon in charge of design and engineering, George M. Hite, supervisor of field operations, and D. K. MacKenzie, Resident Engineer.

Upon completion of the plant and its acceptance by the County, A. E. Sparr was placed in charge as Plant Superintendent, with S. J. Murphy as Maintenance Engineer.

CHICAGO SEWAGE EQUIPMENT

Chicago AER-DEGRITTER



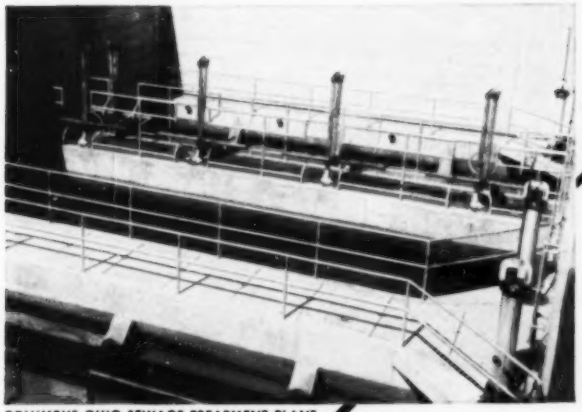
The only method of removing grit and sand from sewage without mechanical equipment is provided by the Chicago Aer-Degritter. The velocity of flow is controlled by air introduced through Chicago Swing Diffusers and Precision Diffuser Tubes. All sand of 0.2 mm. (65 mesh) and larger is washed and deposited in the bottom of the tank.

Less than 10% volatile matter and only a negligible trace of putrescible organics remains in the grit removed. Aer-Degritters may be installed ahead of all mechanical equipment because coarse sewage material will not interfere with the operation of the Aer-Degritter or affect the hydraulic design of the plant.

Here are the basic features of the Chicago Aer-Degritter.

- **MAXIMUM REMOVAL** • **CLEAN GRIT**
- **NO MECHANISM** • **LOW COST**
- **SIMPLE STRUCTURE** • **AIR CONTROLLED VELOCITIES INDEPENDENT OF FLOW**

52 INSTALLED IN TWO YEARS



COLUMBUS OHIO SEWAGE TREATMENT PLANT
Design Flow 160 M.G.D.
PAUL A. UHLMANN & ASSOCIATES
Consulting Engineers

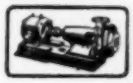
BELLAIRE, TEXAS SEWAGE TREATMENT PLANT
Design Flow .8 M.G.D.
HILTON & COULSON
Consulting Engineers

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

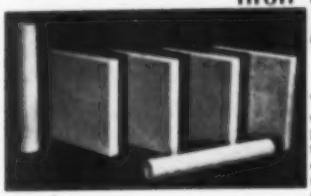
622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.



Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

FILTROS HIGH PERMEABILITY AIR DIFFUSER PLATES



The trend to the use of higher permeability plates (40 to 80 perm.) throughout the Activated Sludge Process Field, finds FILTROS again in the forefront. The same qualities which have made FILTROS famous in the low permeability field are now available in these higher ratings as well. FILTROS round grain construction is a big factor in the long years of service these plates are giving in many outstanding plants throughout the country, such as:

Milwaukee, Wisc., (25 yrs.) — **Hagerstown, Md., (19 yrs.)**
Peoria, Ill., (20 yrs.) — **Phoenix, Ariz., (14 yrs.)**
Chicago North Side, (22 yrs.) — **Mamaroneck, N.Y. (23 yrs.)**

FILTROS long experience as America's pioneers in the manufacture of porous ceramic diffuser plates is at your service, and FILTROS engineers offer personal attention to your problems—whether you are planning new installations, or are having difficulties with your present system. Write for further information, literature, today. (Porous filter bottoms for water filtration and other uses are also available.)

FILTROS, INC.

602 W. Commercial St. — **East Rochester, New York**

Serving the Activated Sludge Process Field with Porous Ceramic Air Diffusers since 1917

PAINT OVER RUST WITH TYGORUST!

"the 'no-prep' vinyl primer"

- minimizes surface preparation
- dries hard in minutes
- goes under any type finish
- provides excellent adhesion
- inhibits rust formation

TYGORUST is a new and unique primer specifically developed to permit the use of TYGON and other vinyl based coatings on rusted ferrous metals. Its outstanding features include easy application — fast drying — high coverage — excellent adhesion to wet or dry rusted steel, wood, concrete, or previously painted surfaces — excellent adhesion for vinyl, nitrocellulose, alkyd, oleoresinous, or bituminous finishes—and, real resistance to rust formation.

Write for details today — try TYGORUST tomorrow!

U. S. STONEWARE CO.
Akron 9, Ohio

Meetings Scheduled

Nov. 3-5—Montebello, Quebec *(Seigniory Club)*
CANADIAN INSTITUTE OF SEWAGE & SANITATION. (Annual Meeting). Sec'y, Dr. A. E. Berry, Parliament Bldgs., Toronto, Ont.

Nov. 5—Taunton, Mass. *(Taunton Inn)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Walter E. Merrill, 511A State House, Boston, Mass.

Nov. 5-7—Old Point Comfort, Va. *(Chamberlin Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, Regional Engr., 708 State Office Bldg., Richmond, Va.

Nov. 10-12—Hendersonville, N.C. *(Hotel Skyland)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 10-12—Hendersonville, N.C. *(Hotel Skyland)*
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 16-19—Pensacola, Fla. *(Hotel San Carlos)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, C. W. White, State Board of Health, 519 Dexter Ave., Montgomery 4, Ala. (Joint Meeting).
FLORIDA SECTION A.W.W.A. Sec'y, Wm. W. Aultman, Box 316, Coconut Grove Sta., Miami 33, Fla. (Joint Meeting).
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, Donald P. Schiesswohl, P.O. Box 210, Jacksonville, Fla.

Dec. 4-5—Stillwater, Okla. *(Oklahoma A. & M. College)*
OKLAHOMA INDUSTRIAL WASTES CONFERENCE. Chairman, Bernal H. Swab, 1911 Linwood, Oklahoma City 4, Okla.

Dec. 4-6—Havana, Cuba
CUBAN SECTION A.W.W.A. Sec'y, L. H. Daniel, Baratillo 9, Havana, Cuba.

Dec. 7-10—Cleveland, Ohio *(Hotel Cleveland)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting). Sec'y, F. J. Van Antwerpen, 120 East 41st St., New York 17, N.Y.

Dec. 10—Winthrop, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Jan. 2, 1953—New York, N.Y. *(Park Sheraton Hotel)*
NEW YORK SECTION A.W.W.A. (Annual Winter Luncheon Meeting). Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York, N.Y.

Jan. 22-23—New York, N.Y. *(Hotel Statler)*
NEW YORK STATE SEWAGE WORKS ASSOCIATION. Sec'y, R. C. Sweeney, 21 No. Broadway, White Plains, N.Y.

Feb. 11-13—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 366 Good Ave., Indianapolis 19, Ind.

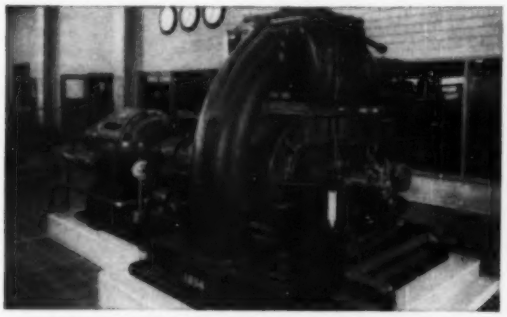
Apr. 16-17—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, Dept. Civil Engineering, University of Nebraska, Lincoln, Neb.

April 16-17—Elmira, N.Y. *(Mark Twain Hotel)*
NEW YORK SECTION A.W.W.A. (Spring Meeting). Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York 20, N.Y.

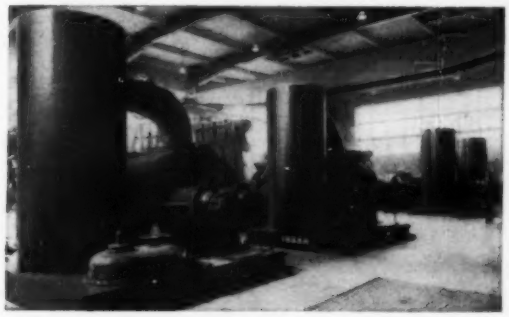
May 10-15—Grand Rapids, Mich. *(Technical Sessions —Auditorium)*
AMERICAN WATER WORKS ASSOCIATION (73rd Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y. (Reservations announcement by Dec. 1st.)

NEW YORK CITY CHOOSES *R-C dual-ability*

Owls Head—4 Centrifugal Blowers, each of 15,000 cfm capacity, driven by direct-connected motors.



Rockaway—2 Dual-Impeller Rotary Blowers, each of 3000/2000/1000 cfm capacity, driven by direct-connected motors.



Hunts Point—4 Rotary Positive Blowers each of 21,000 cfm capacity, driven by diesel engines.

The first Roots-Connersville Blowers for New York City sewage treatment plants were installed at Tallmans Island in 1939. At present, of eight operating, activated sludge plants, five are totally equipped, and one is partially equipped, with R-C Units, selected from the *dual-ability line*. These include engine-driven and motor-driven Rotary Positive Blowers, motor-driven Centrifugal Boosters, Gas Pumps and many R-C Positive Displacement Meters.

R-C equipment was selected because each unit can be closely matched to the needs of each plant, and because of the long-time record of completely dependable performance.

For sewage treatment plants of any size—from a small village or industrial operation to the largest metropolitan area, the exclusive *R-C dual-ability line* is the favorite choice for handling gas or air in any quantities. Our planning facilities are at your service.

ROOTS-CONNERSVILLE BLOWER DIVISION
1152 Mount Avenue • Connersville, Indiana

R-C EQUIPMENT IN NEW YORK CITY PLANTS

Tallmans Island—1939
2—10,000 cfm Rotary Blowers
1—20,000 cfm Rotary Blower

Jamaica—1943
3—15,000 cfm Centrifugal Blowers
12—Positive Displacement Meters

26th Ward—1951
1—20,000 cfm Rotary Blower (moved from Tallmans Island)

Owls Head—1952
3—Rotary Gas Pumps
4—15,000 cfm Centrifugal Blowers
2—Low-Pressure Rotary Blowers

Rockaway—1952
2—3000/2000/1000 Dual-Impeller Rotary Blowers

Hunts Point—1952
4—21,000 cfm Rotary Blowers
9—Positive Displacement Meters

ROOTS-CONNERSVILLE BLOWER
A DIVISION OF DRESSER INDUSTRIES, INC.

VALVE LEAKAGE COSTS MONEY!

STOP YOUR LOSSES WITH DeZURIK VALVES.

Every leaking valve *is* an expensive valve, piling up costs in line-losses as well as in shut-downs, clean-up time, repairs and replacements. DeZURIK Easy-Operating PLUG VALVES will stop those losses in your plant because they STOP LEAKS. On any water or sewage flow—even those with the heaviest suspensions—DeZurik's long-life, rubber-faced plugs seal dead-tight every time. They're YOUR answer to YOUR problem.

Write for complete catalog of DeZurik friction-free EASY-OPERATING VALVES.

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Just one block from the Municipal Auditorium — Convenient to business, shopping and theatrical districts . . . Tastefully Decorated Guest Rooms . . . Banquet Rooms . . . Club Rooms . . . Sample Rooms . . . Hotel Coffee Shop . . . Bar . . . Cocktail Lounge . . . Parking Facilities.

400 OUTSIDE ROOMS

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KANSAS CITY, MISSOURI

STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)

Of *Water and Sewage Works*, published monthly at Mount Morris (Ogle County), Illinois, for October 1, 1951.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Edward S. Gillette, 22 W. Maple St., Chicago 10, Ill.

Editor, L. H. Enslow, 155 East 44th St., New York 17, N.Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Gillette Publishing Co., 22 W. Maple St., Chicago 10, Ill.

L. H. Enslow, 155 East 44th St., New York 17, N.Y.

H. P. Gillette, 22 W. Maple St., Chicago, Ill.

Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.

Louise E. Forsythe, 410 Thayer Road, Swarthmore, Pa.

Mrs. R. W. Hume, 303 South Stone Ave., LaGrange, Ill.

Provident Trust Co., 17th and Chestnut Sts., Philadelphia, Pa.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

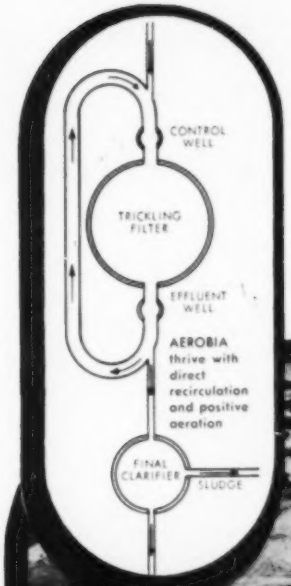
4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDWARD S. GILLETTE,
Publisher.

Sworn to and subscribed before me this 1st day of October, 1951.

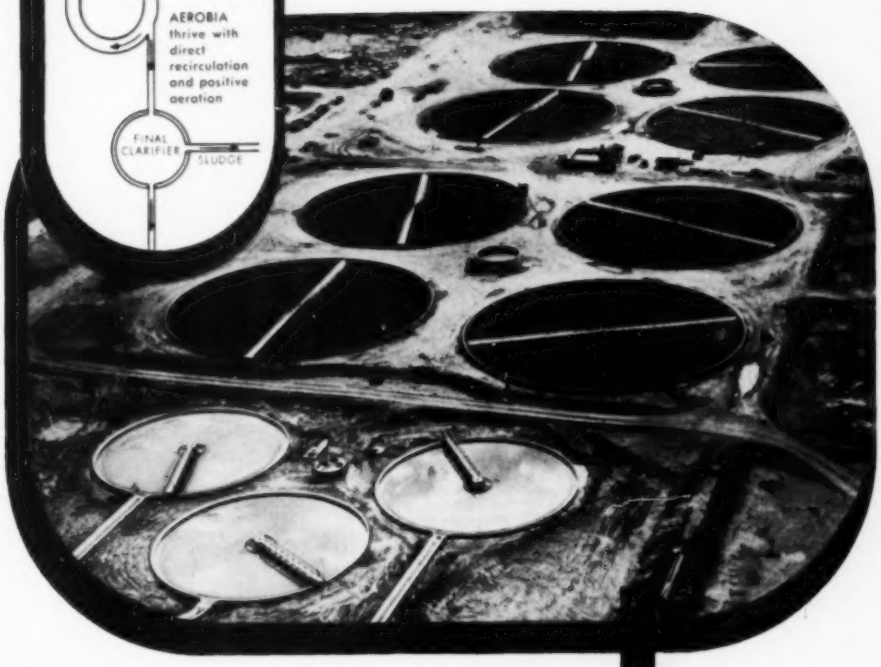
(Seal) CLARE MEHL.

(My commission expires Dec. 18, 1952.)



how Worcester, Mass., modernized 1925 Sewage Plant with an

Accelo® Filter *system*



To give Worcester a modern 20,000,000 g.p.d. treatment plant, consulting engineers replaced 1925 equipment with the Infilco Accelo Filter system with *direct recirculation* and *positive aeration*. The system has 8 rotary distributors 176 ft. in diameter with aero-spray nozzles. Excellent distribution is obtained over filter surfaces with vigorous growth of bacterial gel. Three Infilco PD Clarifiers (foreground) provide effective final sludge removal.

Specify Infilco for:

- INCREASED FILTER EFFICIENCY
- NO INCREASE IN CLARIFIER SIZE
- INCREASED CAPACITY
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- NO ODORS
- REDUCED PSYCHODA FLY NUISANCE

INFILCO
* BETTER WATER CONDITIONING * AND WASTE TREATMENT SINCE 1894

INFILCO INCORPORATED | *Tucson, Arizona*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

lengthen the life...
increase the efficiency...
reduce operating costs...

IN YOUR POWER PLANT!

4 PROBLEMS

you can solve with

BECKMAN pH Control

Make vitally important savings in the cost of operating and maintaining your power plant by Beckman-controlling the pH of your feed water and steam processes. You can protect costly plant equipment against damaging calcium deposits . . . can reduce requirements of costly chemicals and treating materials.

There is a size and type of Beckman pH meter—from strictly portable to installed, completely-automatic pH control—for every power plant requirement.

1 REDUCE COSTLY CORROSION

(especially in steam condensate equipment). Rate of corrosion is a function of the pH of the water. Maintaining high pH minimizes corrosion through formation of protective oxide coatings. pH must be sufficiently high to minimize corrosion, yet low enough to prevent calcium precipitation (see below). **Peak efficiency can be obtained only through accurate pH control!**

2 PREVENT CALCIUM DEPOSITS

For each type of softening operation there is a definite pH at which optimum precipitation of calcium is obtained. By controlling the pH, minimum residual hardness is assured. Then, what little hardness remains, is prevented from precipitating in condensers, exchangers, valves, etc., by **lowering** the pH in this part of the system. **Again—peak efficiency can be obtained only through accurate pH control!**

3 OBTAIN MAXIMUM EFFICIENCY

in removing impurities through coagulation. Formation of the floc is greatly influenced by the pH of the solution and type of coagulant used. If alum is used, maximum floc is obtained at a moderately acid pH value . . . if sulphates predominate a **lower** pH value gives best floc . . . while if chlorides predominate, a **higher** pH value (slightly alkaline) must be maintained. **Optimum sedimentation can be obtained only through accurate pH control!**

4 PROTECT VALUABLE ZEOLITE

Zeolites are rapidly disintegrated by water with **low** pH and are also softened and disintegrated by water of **high** pH. By Beckman-controlling pH before water enters Zeolite, costly chemical losses are eliminated and vital plant economies are effected. **Here again, topmost efficiency can be obtained only through accurate pH control!**

Illustrated at right is the Beckman Model R pH Indicator—the ideal equipment for power plant installations.

For more details on Beckman pH Equipment and the savings to be made in power plant applications, write for your free copy of Data File 82-20

BECKMAN INSTRUMENTS
Control modern industries

BECKMAN INSTRUMENTS, INC.
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Factory Service Branches: New York · Chicago · Los Angeles

BECKMAN INSTRUMENTS include: pH Meters and Electrodes · Spectrophotometers · Radioactivity Meters · Special Instruments

Camp, Dresser & McKee Expands Partnership

Camp, Dresser & McKee, Consulting Engineers of Boston, have announced the expansion of the partnership to include three associates. In addition to Thomas R. Camp and Herman G. Dresser, the firm now includes the three new partners: Roland S. Burlingame, Joseph C. Lawler and Darrell A. Root.

Mr. Burlingame was graduated from the University of New Hampshire in 1933. Prior to coming to Camp, Dresser & McKee in 1946 he was a sanitary engineer with the Navy Department and an officer in the Sanitary Corps of the U. S. Army.

Mr. Lawler was graduated from Northeastern University in 1943 and received a master's degree from Harvard University in 1947. He became associated with Camp, Dresser & McKee in 1947.

Mr. Root obtained his bachelor's and master's degrees from M. I. T. in 1935 and 1939 respectively. He directed the hydraulic and structural planning and design of the large sewage disposal project for the East Bay Municipal Utility District, Oakland, Calif., and has been associated with Camp, Dresser & McKee since 1950.

Pollution Abatement Progress in Ohio River Valley Area

Reviewing progress in pollution abatement in the area embraced by the Ohio River Valley Water Sanitation Commission, E. Blackburn Moore, chairman, recently reported that facilities serving almost a million people were either completed, under construction or approved to move into the construction stage during the past year.

The significant changes in the municipal sewage-treatment picture were summarized as follows:

	Number	Population Served
New plants in operation	22	61,000
Plants or additions under construction	25	555,300
Final plans approved	47	326,700
	94	943,000

Pointing out that this progress provided evidence that the eight states in

(Continued on page 96A)

there's a WARREN pipe size...

to meet any requirement!

What size Cast Iron Pipe do you need? . . . 2 inches to 96 inches . . . strong, durable, made with proper beam, crushing, shock and bursting properties? We make it!

Cast in regular sizes (with fittings) and non-standard patterns in many different dimensions and fittings that help solve unusual installation problems. 96 years experience at your disposal.

- Bell & Spigot Pipe
- Flange Pipe
- Flexible Joint Pipe
- Short Body Bell & Spigot Specials
- Cast Iron Rolls
- Cylinders
- Special Castings

Also manufacturers of special castings in medium and heavy weight Alloy Iron, Grey Iron and Meehanite Iron for special purposes. Catalog and Brochures available.

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AND BE SURE!

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55 LIBERTY STREET, NEW YORK 5, N. Y.

PLANTS: Phillipsburg, N. J. Everett, Mass.

WARREN PIPE CO. OF MASS. INC. 75 FEDERAL ST. BOSTON, MASS.

96 Years of Continuous Service

THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

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MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks— Nation Wide Service—33 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for three years, repairs guaranteed for ten years, provided the tank is painted every three years by Dixie Tank and Bridge Company, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

Dixie's Nation Wide Service Satisfies

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

(Continued from page 94A)

the Ohio River Valley were living up to their pledge of cooperative action under the compact for the control of pollution. Mr. Moore called for stronger emphasis on clean-up action by communities and industries on the main stem of the Ohio River.

He pointed out that two public hearings already have been held by the Commission on sewage treatment requirements in a 190-mile stretch of the Ohio River and that others would soon follow. Meantime, the Commission is issuing notices for compliance to 19 municipalities and industries in Ohio, 25 in Kentucky and 6 in West Virginia, which are now discharging sewage in the sections where public hearings have been conducted.

Study of Plastic Pipe for Water Uses

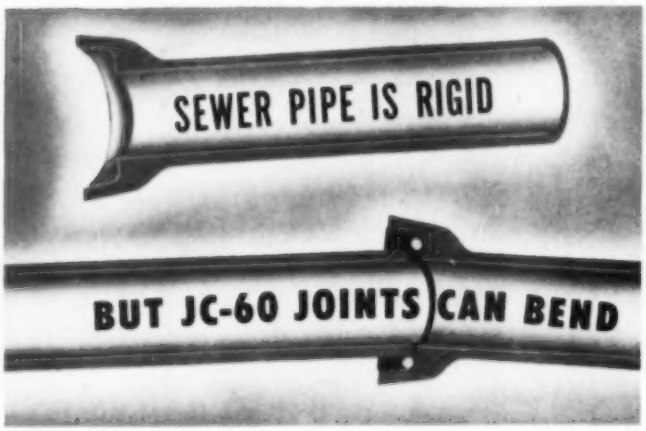
A research project to determine the suitability of plastic pipe for the transmission of water has been undertaken by the Society of the Plastics Industry, Inc., at the National Sanitation Foundation at the University of Michigan, Ann Arbor.

The project resulted from the reluctance of public health officials to approve installation of plastic pipe for water transmission systems in the absence of an authoritative statement on its advantages and toxicological characteristics. Plastic raw materials to be tested first are polyethylene polystyrene, cellulose acetate, butyrate, and copolymers of polyvinyl chloride.

Working with the society are Walter F. Snyder, foundation executive director, and Walter D. Tiedeman, director of the testing laboratory.

Consultants include C. W. Klassen, chief sanitary engineer for the state of Illinois, and B. A. Poole, director of the bureau of environmental sanitation for the state of Indiana.

Society members participating include Anesite company and Elmer E. Mills corporation, both of Chicago. Others include E. I. du Pont de Nemours & Co., Dow Chemical company, Monsanto Chemical company, Goodyear Tire and Rubber company, B. F. Goodrich Chemical company, and Bakelite company, a division of Union Carbide and Carbon corporation.



Joints poured with ATLAS JC-60, are stronger than the sewer pipe itself, yet flexible enough to withstand normal settling. Even on low temperature deflection tests, JC-60 joints have taken a 15° bend without *any* rupture of the leakproof bond. Compare these assuring results with other jointing compounds. Notice that the JC-60 compound holds . . . while others may fail.

Advantages of JC-60 such as positive resistance to root penetration, flexibility and others save you money . . . both in negligible maintenance and minimum pumping costs throughout years of service.

Get the complete facts. Write for your copy of new Bulletin M20-3.

ATLAS MINERAL MORITZTOWN PENNSYLVANIA HOUSTON TEXAS

ATLAS JOINTING COMPOUNDS
...a permanent bond

Jacobson Heads Columbia's Div. of Sanitary Science

Columbia University School of Public Health announces that Dr. Alvin R. Jacobson, Associate Professor of Sanitary Science, has been placed in charge of the Division of Sanitary Science. Dr. Jacobson served as Water Chemist with the Iowa State Hygenic Laboratory, Chief Chemist and Superintendent of Water Purification in Kansas City, Missouri, and was Associate Professor of Sanitary Chemistry at New York University College of Engineering. During World War II, Dr. Jacobson was an Officer in the Epidemiology Corps of the U. S. Navy. He has recently served as a Consultant to the Department of Health of the Virgin Islands in connection with water, sewage and industrial waste problems.

Rensselaer Water Co. Purchased by City

The Water System owned by the Rensselaer Water Company, serving the City of Rensselaer and the adjacent town of East Greenbush, New York, was transferred to the City of Rensselaer on September 22, 1952. The amount paid was approximately $450,000. The controlling interest of the Rensselaer Water Company was owned by the Geo. F. West Co. of Portland, Maine.

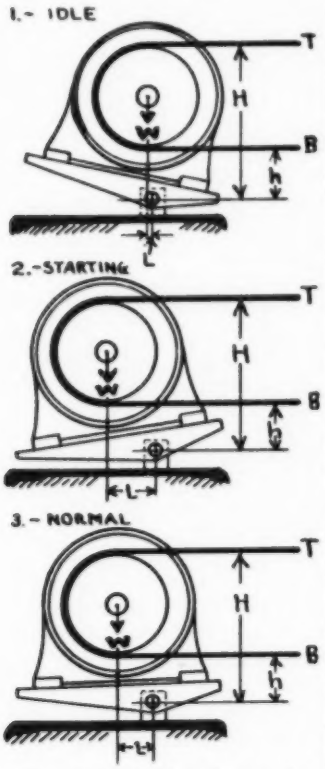
The former Superintendent of the Rensselaer Water Company, Mr. Charles R. Claflin, has been made Commissioner of water for the city

and will continue to operate the water plant. Mr. Claflin was made a life member of the A.W.W.A. at the Fall meeting of the New York Section at Saranac Inn, N.Y.

The Hinged Motor*

The Why of These Motors Little Understood by Many

The action of the hinged motor, which is now being so commonly employed, continues to be shrouded in mystery. Many operators watch these drives curiously as the motor moves to and fro, but they don't know "why" because, so far as this writer is aware, there has never been a simplified explanation.



The above sketches show such a drive when 1—Idle; 2—Starting; and 3—Running Normal.

The lower side (B) is the tight side of the belt, and the top side (T) is the slack side. The tight side is considerably closer to the pivot, the distance being (h). The slack side is farther away from the pivot, the distance being (H). This means that the belt (T) has a longer "lever

*Contributed by Wm. F. Schaphorst, M.E., Newark, N.J.

Saran rubber at work—saran rubber is used as a membrane under one course of chemical brick in these ethyl benzene reactors. The reactors handle ⅓ ethyl benzene, ⅓ higher benzenes, ⅓ benzene and .3% hydrochloric acid, and operate at a temperature of 110° C. Although this exceeds the temperature recommended for saran rubber, the towers have been in service three years without appreciable change in the saran rubber lining.

BOOST EQUIPMENT LIFE!

use

SARAN

RUBBER TANK LINING!

Saran rubber combines the physical properties of rubber with the chemical resistance of saran. The resulting high degree of chemical and abrasive resistance makes saran rubber an outstanding lining where resistance to grease, many solvents, acids and other chemicals is indicated.

Industries handling, storing or transporting corrosives find that saran rubber tank lining helps achieve lower operating costs and increase the life expectancy of costly equipment. Saran rubber is easy to apply; experienced tank lining applicators are located throughout the country. For further information contact your nearest Saran Lined Pipe Company office.

for tank cars
storage tanks • tank trailers
processing tanks
production tanks

RELATED PRODUCTS

Saran rubber molded parts—stoppers, diaphragms, various-sized moldings for valves, instruments, etc.

Saran lined steel pipe—corrosion-resistant pipe that gives long-term operation with minimum maintenance costs.

Write to the Distributor:

SARAN LINED PIPE COMPANY

2415 BURDETTE AVENUE • FERNDALE, MICHIGAN

Offices in: New York • Boston • Pittsburgh • Tulsa • Philadelphia Chicago • Portland • Indianapolis • San Francisco • Houston • Denver Los Angeles • Seattle • Cleveland • Charleston, S.C. • Toronto • Montreal

Saran Lined Pipe Company
2415 Burdette Avenue, Ferndale, Michigan

Please send me your catalog on Saran Rubber Tank Lining and Saran Rubber Molding Stocks.

Name _____ Title _____

Company _____

Address _____

City _____ State _____

SR-510-E

SARAN RUBBER
a
DOW
product

arm" around the pivot and that is why the tension in that side determines the position of the motor. Thus, for instance, when the drive is idle the tensions in (T) and (H) are equal, the pull in (B) being less than at any other time and the pull in (T) being greater than at any other time. Therefore, the motor is pulled over farthest.

On starting, the tension in (T) is practically nothing, while in (B) it is greater than at any other time. Therefore, the motor drops to its lowest point. Then, while running normally, the tension in (T) is a little greater and that in (B) is a little less than when in position (2) and as a result the motor is in a "between" location.

And that's all there is to it. In other words, the tension in the "slack side" is mostly responsible for the position of the motor. Why? Because of its longer lever arm.

The reason for the hinged motor is to maintain the proper tension in the belt at all times.

Ohio Water Clinic Papers Published

The two-day "Water Clinic" held at the Ohio State University in February, 1952, brought together many different interests in the field of water use—water supply, sewage disposal, industrial waste treatment, conservation, natural resources, legislative and irrigation. An attendance of 275 was considered such good evidence of the appeal to diverse interests that another clinic is being planned for the same month next year.

The 21 papers presented in the clinic have been published under the title "Proceedings of the First Ohio Water Clinic—1952." For this 154 page booklet write to the Engineering Experiment Station, the Ohio State University, Columbus, Ohio, requesting Bulletin No. 147. Cost per copy is $1.00.

THE **DISC** THAT SETS A NEW HIGH IN CHLORINATING EFFICIENCY . . .

NO, it's not a flying saucer —

it's the metal diaphragm from the chlorine control valve of a BUILDERS Visible Flow CHLORINIZER. Made of tantalum — the only metal completely unaffected by both dry and moist chlorine gas — this diaphragm has established a new set of standards in chlorinating efficiency.

Because of this flexible metal disc, chlorine gas flow can now be regulated by means of a simple, trouble-proof hydraulic system. This metal disc has completely eliminated the need for stuffing boxes or packed valves in the chlorine flow line. This metal diaphragm has permitted the perfection of a super-safe chlorine gas feeder — one which incorporates a powerful spring ready at all times to cut the chlorine flow should *any* condition interfere with safe operation.

Safety, simplicity, and thorough dependability — these are the built-in features of BUILDERS CHLORINIZERS. For descriptive Bulletins and detailed information on these modern chlorine gas feeders, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Ave., Providence 1, R. I.

BUILDERS PROVIDENCE Instruments

Pickups from "Sanitary Engineering News"

Don E. Bloodgood, Editor

The question has arisen several times in the last few months whether it is any longer reasonable to include iron steps in specifications for manholes. Elimination of steps will be more economical and many think just as safe, if not safer.

* * *

It takes 4.3 ppm. of iodine to kill test organisms when the pH is 9.15 and the temperature is 5°C, but it only takes .6 of ppm. of iodine to get the same kill when the pH is 6.5 and the temperature 26°C.

* * *

A study on household sewage disposal systems indicates decreased production of gas with increased concentration of a commercial detergent.

* * *

There are ten interstate water sanitation compacts in the United States.

* * *

The Rochester, N. Y. Gas and Electric Corp. uses reinforced concrete pipe for manholes and they find that it takes less time to install them and saves at least 30% in cost.

* * *

Learn to like what you have to do instead of wishing you could do what you like.

* * *

Pax, W. Va., is the first municipality in the U. S. to use plastic pipe throughout in a city water system. Plastic pipe was chosen because ordinary metal pipe disintegrates rapidly in the sulfur-bearing shale and sandstone formation in the community.—*(W. & S. W.*, Jan., 1952.)

Vice Jaw for Tubing or Plated Pipe

1101

Robert Austin Corporation, Boston, Mass. has introduced an improved "Smoothgrip" Vice Jaw for tubing or plated pipe.

"Smoothgrip" will not mar, scratch or distort, and locks into positive grip by simply depressing handle. It is adjustable to desired pressure. Standard jaws fit ISP ⅜ to ¼ inches and type L or K copper tubing from ½ to 1½ inches. Additional jaws are available to fit any type of tubing or bar stock from 3/16 to 1½ inches and built-in lugs provided permanent or temporary attachment.

James O. Wright
President

Joseph E. Johnston
Vice President

Badger Meter Elects New Officers

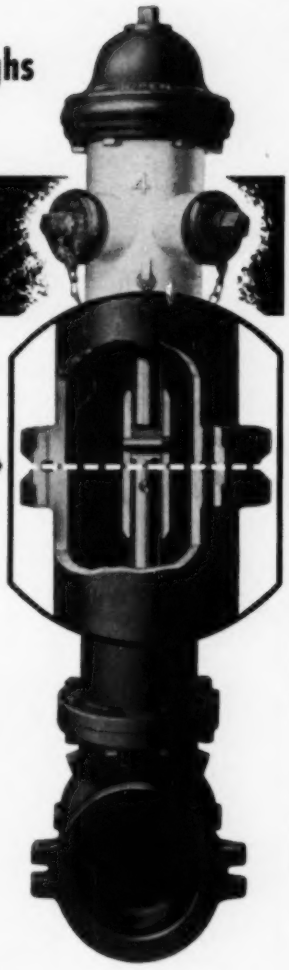
Badger Meter Manufacturing Co., Milwaukee, Wis., has announced the election of James O. Wright as President of the company. Mr. Wright succeeds his father, the late Charles W. Wright.

William C. Wright, twin brother of James, was elected Vice President in charge of manufacturing. Both brothers served as officers in the U. S. Navy and have been with Badger for many years. James has been identified with every phase of the business, while William has concentrated in production.

Other officers elected were Joseph E. Johnston, Vice President in charge of sales, who joined the organization in 1928, and P. J. Berner, Secretary-Treasurer, who has been

The Hydrant that Laughs at Traffic Hazards

KENNEDY
SAFETOP



As tough as they come . . .

but when it breaks, it's as clean as a whistle . . . at ground level.

yet, it's back in service in twenty minutes.

The safety breakable section of a KENNEDY Safetop Fire Hydrant will take all the punishment that a standard one-piece hydrant will. But when a couple of tons of flying steel hits it at high speed—and it's more than any hydrant can take—it breaks cleanly and evenly at ground level.

Within twenty minutes of arrival at the scene one man can have it back in service—no excavation—no water—no hoists—no costly replacements. A new breaking ring and a new stem coupling are all that are usually required.

Write for Bulletin No. 105

Where there is no traffic hazard install a KENNEDY Standard Hydrant with one-piece standpipe and stem

- **The same minimum friction, maximum water supply design.**
- **The same positive drainage to protect against freezing.**
- **The same leak-proof construction and ease of inspection . . . and all parts interchangeable with the SAFETOP except the standpipe and stem.**

Write for Bulletin No. 109

THE **KENNEDY**
VALVE MFG. CO. • ELMIRA, N.Y.
Est. 1877
VALVES • PIPE FITTINGS • FIRE HYDRANTS

with Badger since 1944. In addition, Mr. Johnston was appointed to the Board of Directors, and Mr. Berner was named a Director and member of the Executive Committee.

Lock Joint Pipe Co. Appionts Sweitzer

The Lock Joint Pipe Company has announced the appointment of Robert J. Sweitzer to its sales staff. Mr. Sweitzer will work from the home office of the company in East Orange, N.J.

Mr. Sweitzer formerly conducted his own business as consultant in hydraulics, and prior to that had served as District Engineer of the American Water Works Service Co., Inc.

New Porcelain Enamels Fight Corrosion

1102

Porcelain Enamel Finishers, Chicago, Illinois, has announced the development of special new porcelain enamels designed to fight corrosion.

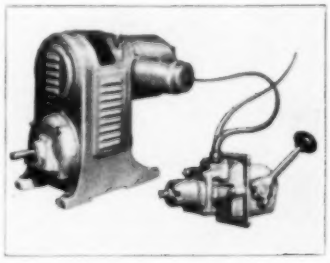
According to the company, these new enamels will find specific application in water supply and sewage disposal plants where corrosion from water and sewage poses a serious problem.

Fred E. Stuart, Jr. Joins "Dad" in Stuart Corp.

Stuart Corporation, Baltimore, Maryland, has announced that Fred E. Stuart, Jr., son of Fred E. Stuart, Sr., president, has joined the corporation as Chemical Engineer.

Fred, Jr., received his degree in Chemical Engineering from Georgia Tech in 1949. Since graduation he has been associated with the Universal Oil Products Company, Chicago, Ill., being employed on nationwide technical service work.

In the announcement by Fred Stuart, Sr., he stated that "We are very glad to have a Chemical Engineer associated with Stuart Corporation as our products are beginning to be applied in industrial waste treatment as well as in industrial and municipal water treatment."

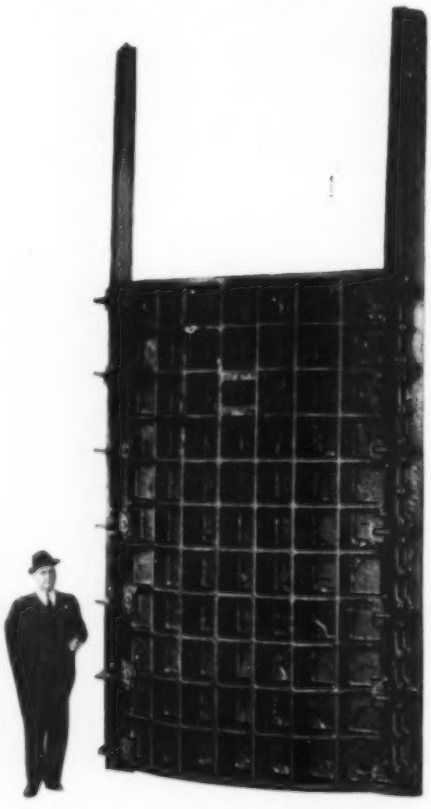


Pneumatic Remote Control for Varidrive Motors

1103

U. S. Electrical Motors, Inc., Los Angeles, Calif., has developed a pneumatic remote control that governs variations in speed of U. S. Varidrive motors.

The control consists of a positioning unit—an air operated plunger attached to the Varidrive speed changing device and an air valve which remotely controls the positioning unit. Four types of valves are available depending upon the method desired to operate the mechanism—pedal, lever, cam or wheel. The positioning



FILER & STOWELL SLUICE GATES

are built to stand long trouble free service. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.

THE FILER & STOWELL COMPANY
MILWAUKEE 7, WISC.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

units are designed to operate with an air pressure of either 60 or 100 psi.

Through the use of check valves and control stations selectors in the system, the speed of the Varidrive can be changed from any number of control stations. Conversely, any number of varidrives may be controlled by one station providing they are to operate at the same speeds.

Dixon Appointed Vice Pres. Rockwell Meter & Valve Division

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced the appointment of L. A. Dixon, Jr., as Vice-President of the Company's Meter and Valve Division. Mr. Dixon will coordinate the sale and manufacture of gas, water and oil meters, gas pressure regulators and Nordstrom Valves.

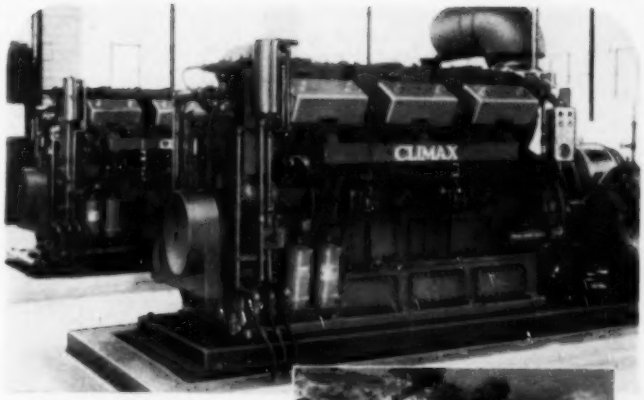
Mr. Dixon started in the Engineering Department of the Pittsburgh-Dubois Company and in 1944 was made Executive Vice-President. When Rockwell acquired that company in 1947 he became General Manager. Mr. Dixon was later transferred to the parent company headquartered in Pittsburgh, and prior to his recent promotion served as Assistant Vice-President of the Company's Meter and Valve Division.

Test Gauge for Pressure Instruments

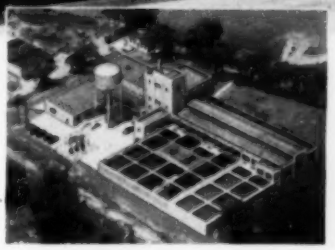
1104

The Foxboro Company, Foxboro, Mass., has announced the development of the 6 inch Model P Test Gauge.

This instrument not only serves in checking pressure controllers, record-



Two Climax 420 H.P. 12 cylinder gasoline engines direct connected to 6 MGD centrifugal pumps in Municipal Water Works, Moline, Illinois.



Aerial View of Moline's New Pumping Station.

climax BLUE STREAK ENGINES

GUARD MOLINE'S WATER SUPPLY

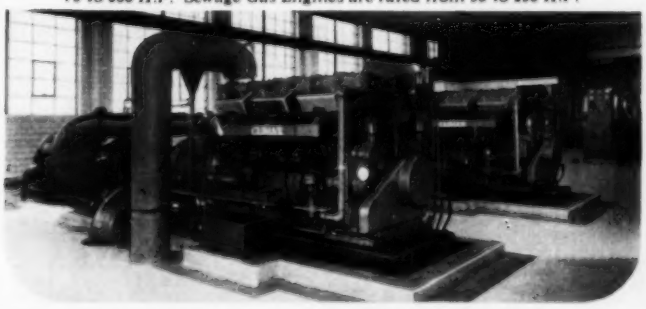
Moline, a fast growing industrial city in Western Illinois, installed two Climax 12 cylinder and one 6 cylinder engines to guard their water supply. They are used as standby power for pump units during electrical power failures.

Selected because of their low upkeep expense, economy and their ability to provide quick dependable power to meet all emergency demands. Climax Engines have been approved and preferred by a growing number of municipal water works for standby service.

climax ENGINE AND PUMP MFG. CO.

Factory and General Office: Clinton, Iowa
Regional Offices: Chicago, Ill., Dallas, Texas

For emergency use in water works Climax Engines are rated from 75 to 600 H.P. Sewage Gas Engines are rated from 50 to 250 H.P.



ers and indicators, but also furnishes a standard of accuracy for calibrating other pressure testing equipment in the instrument department.

The 6 inch Model P Test Gauge is furnished in ranges of 0-30 Hg vac. up to 0-10,000 psig, and guaranteed accurate within ½ of 1 per cent of the total scale at any point throughout its range. Suitable tapered pipe male thread connections are provided.

Chain Belt Adds Four New Distributors

Chain Belt Company, Milwaukee, Wis., has announced the addition of four new distributors for products of the Chain and Transmission Division, Conveyor and Process Equipment and Baldwin-Duckworth Divisions.

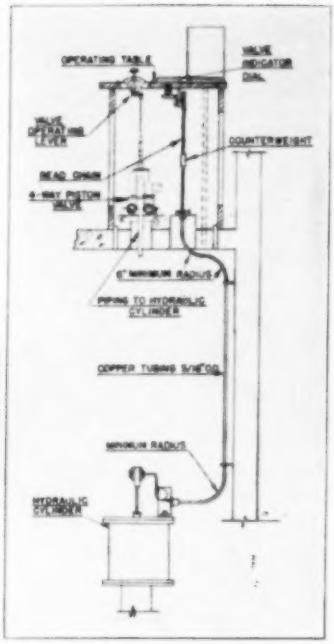
The new distributions are:

Dodge-Yakima Supply Company, 109 South Front St., Yakima, Wash.

Leibfried Sales Co., 9106 Blake St., Denver, Colorado.

Brown-Roberts Hardware and Supply Co., Ltd., 1202 Third Street, Alexandria, Louisiana.

Valley Foundry & Machine Works, 2718 East Avenue, Fresno, Calif.



Enclosed Mechanical Drive for Operating Table Valve Indicators

1105

Builders-Providence, Inc., Providence, R. I., has announced a new improved valve position indicator for filter operating tables.

This system using an enclosed bead chain, is entirely mechanical in its operation and requires no electrical, water, or air connections. The monel bead chain is enclosed in a sheath of copper tubing. It is corrosion proof, cannot be damaged or knocked out of adjustment, and eliminates difficulties experienced with conventional cable and pulley arrangement.

"FLEXIBLE" Exclusives THAT Revolutionized SEWER CLEANING

Since 1932 FLEXIBLE has led in pioneering improved sewer cleaning methods and equipment. Here are today's most important "FLEXIBLE" musts!

The **SeweRodeR**

A mechanical marvel that does all rodding with one man and a helper. Pushes, turns, pulls . . . pulls back loads and "rods in" for more.

FLEXICROME ROD COUPLING

An improved coupling recommended for HIGH-SPEED POWER TURNING . . . developed through years of experience. Never connects in the wrong hole. Faster to assemble.

***Surface-Hung* MANHOLE ROLLER**

Works loose brick manholes (any size) far faster. Fits any two leg bucket machine. Installs from above ground.

WRITE today

"FLEXIBLE"

SEWER-ROD EQUIPMENT CO.

9059 VENICE BOULEVARD, LOS ANGELES 34, CALIF.

41 Greenway St. – Hamden 14, Conn.
147 Hillside Terrace – Irvington, N. J.
P. O. Box 485 – Memphis, Tennessee
1115 Delaware Ave. – Fort Pierce, Fla.
141 W. Jackson Blvd. – Chicago, Ill.
200 Magee Bldg. – Pittsburgh, Penn.
66 Kinlry Drive – Rochester 9, New York
29 Cordan Avenue – Roslindale 31, Mass.
801 E. Excelsior Blvd. – Hopkins, Minn.
3780 Durango St. – Los Angeles 34, Calif.
4455 S.E. 24th Street – Portland, Oregon
351 West Jefferson Blvd. – Dallas, Texas
Francis Hankin – Montreal & Toronto, Canada

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

Buffalo Meter Company Honors G. B. Bassett

Buffalo Meter Co. honored its founder and board chairman, George B. Bassett, at a dinner on October 1st, celebrating the 60th anniversary of the founding of the company.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

George Bassett was born on June 17, 1861, at Ballston Spa, N.Y. He studied engineering at Sheffield Scientific School, New Haven, Conn., and in the office of F. A. Hinds, City Engr. and Waterworks Supt., Watertown, N.Y. In 1886 at Buffalo, N.Y., he formed a partnership with his brother Edward (Bassett Brothers) which designed and built 53 water works.

After considerable study, George Bassett designed a simple and practical water meter. He established the Buffalo Meter Co. on October 1, 1892, and sold the first water meters to the village of Bath, N.Y., in 1893. These meters were of the conical disc type, which was made until 1905 when the design was changed to the flat disc type. The sale of water meters has always been the larger part of company activity and today its meters are in use in more than 2,500 U.S. communities.

Mr. Bassett, while President of the company, was a member of the A.S.M.E., A.S.C.E., and Engineering Society of Buffalo. He is a life member of the American Water Works Assn.

Corrosion-Resistant Synthetic Coating

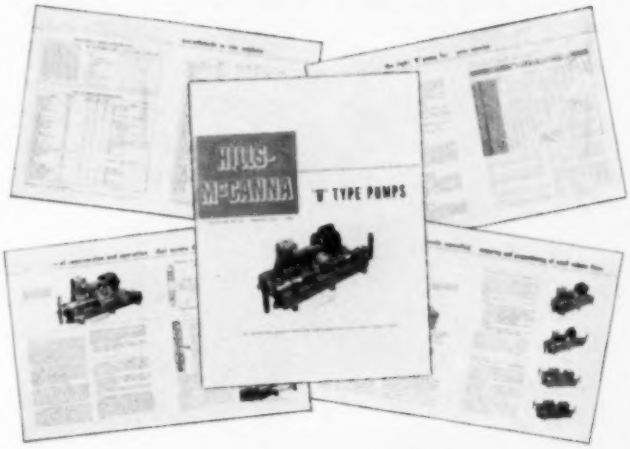
1106

The Monroe Company, Inc., Cleveland, Ohio, has announced a new corrosion-resistant synthetic coating for wood, masonry and metal surfaces.

Known as POZCOTE, the coating contains inert synthetic resins and, it is said to be impervious to water, acids, alkalis, alcohol, syrups, oils and grease.

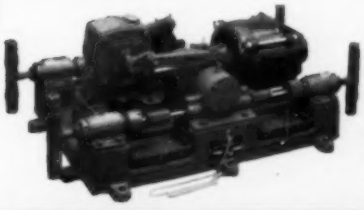
The company states that POZCOTE is tough and long wearing,

Here's a handy guide to the selection of metering and proportioning pumps



In this new catalog and pump selection manual for Hills-McCanna "U" Type Metering and Proportioning Pumps is all the information, including prices, for the selection of exactly the right pump for handling over 300 substances. Clearly and concisely, this helpful booklet gives all the necessary information and specific recommendations to cover the vast majority of needs that can be filled with a Hills-McCanna "U" Type Pump.

If your operations involve the metering or proportioning of small volume flows, you will find this catalog a useful addition to your files. We will be pleased to send you a copy on request. HILLS-McCANNA COMPANY, 2357 W. Nelson St., Chicago 18, Illinois.



Hills-McCanna "U" Type Pumps are reciprocating, variable stroke, mechanical drive units with maximum capacities ranging from 0.10 to 24 gph. per feed. One, two, three and four feed assemblies are available. Operating pressures up to 5,000 psi. A four feed unit is shown at the left.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of: Saunders Patent Diaphragm Valves Force Feed Lubricators • Magnesium Alloy Sand Castings

and stands up as a floor coating under heavy trucking and foot traffic. It can be used indoors or out and, because of its elasticity, will not crack or peel from temperature changes.

DeCelle Establishes Manufacturers' Agent Firm

O. A. DeCelle and Associates is the name of a new manufacturers' firm recently established by Mr. DeCelle at 4900 W. Madison St., Chicago, Illinois.

The firm will represent manufacturers of water, sewage, and industrial waste treatment equipment, industrial equipment and process materials. The territories covered by the firm are northern Illinois, northern Indiana, southern Wisconsin and western Michigan.

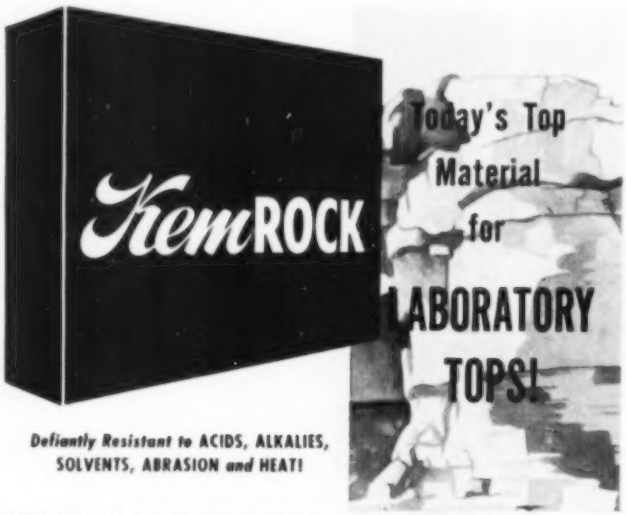
Year at Worthington for Foreign Workers

One French and one Italian worker from plants abroad are now learning the production know-how, customs and ways of the American worker at the Harrison plant of Worthington Corporation. They'll be at it for one year.

The two workers are part of a group of 200 now working in plants throughout the U.S. Their objective is to learn the ways of American production and eventually pass on their knowledge to their European co-workers when they return. Brought to this country by the Mutual Security Agency under provisions of the Marshall Plan, they will be joined by other European workers until they number 2,000. Some $20,000,000 of Marshall Plan funds have been allotted for the program.

Roger Coulon, 31, of Paris is in training at the Worthington plant as an external grinder, a job consisting of tooling and finishing machinery parts.

Bruno Avaldi, hired for his year's stay as a toolworker, was a foreman at a plant near Turin in Northern Italy. The plan calls for the workers to live with fellow employees while here, whenever possible. Thus they learn the customs, habits and qualities of the American home.

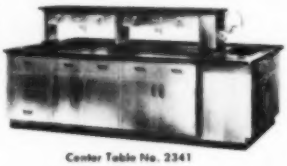


Defiantly Resistant to **ACIDS, ALKALIES, SOLVENTS, ABRASION** *and* **HEAT!**

KemROCK Tops are sawed slabs of quarried porous stone, impregnated and coated with a synthetic resin—then baked at high heat. The result is an amazingly tough, acid-resistant, jet black product, which takes a high polish and becomes the most beautiful and serviceable material for all Laboratory Tops.

11 Years in Actual Use Proves How KemROCK Tops Stand Up

Repeat orders from Laboratories equipped in 1941 again specify—"Equip with KemROCK Tops and Sinks." You, too, will find it well worthwhile to protect your investment in Laboratory Desks, Sinks, etc., by making sure you get KemROCK—an exclusive Kewaunee Product. Write for Special Folder on KemROCK.



Center Table No. 2341

Wall Sink No. 210

End Sink No. 217

Ask for Special KemROCK Folder

Kewaunee Mfg. Co.
J. A. Campbell, President
5102 South Center Street • Adrian, Michigan
Representatives in Principal Cities

Anti-Corrosion, Pressure-Sensitive Tape for Pipe-Wrapping

1107

Minnesota Mining and Manufacturing Co., St. Paul, Minn., has announced the development of two new corrosion resistant tapes that combine the anti-corrosion qualities of poly-vinyl chloride and the ease of application of a pressure-sensitive tape.

Designated "Scotchrap" pipe insulation No. 50 and 51, they are packaged and sold by the square (each square is 100 square feet).

The tapes are recommended for wrapping all small-diameter pipe; for wrapping sections of uncoated pipe, both new and reconditioned; for resealing or repair jobs, and for wrapping joints or coupling on mill-wrapped pipe.

"Scotchrap" pipe insulation No. 50 is 10 mils thick and is recommended for wrapping joints where conformability to irregular surfaces is desired, while the No. 51 tape is 20 mils thick and is recommended for wrapping straight runs of pipe.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Beckman Appoints Steinkamp Vice Pres. and Sales Manager

Beckman Instruments, Inc., South Pasadena, Calif., has announced the appointment of William H. Steinkamp as Vice President and General Sales Manager of the Company.

Mr. Steinkamp comes to Beckman after 22 years association with the Brown Instruments Division of Minneapolis Honeywell Regulator Company where he served last as General Sales Manager. He will make his headquarters at the South Pasadena plant.

R. G. Baker

C. C. Bray

Executive Appointments at De Laval

De Laval Steam Turbine Co., Trenton, N.J., has announced the appointment of Mr. R. G. Baker as Regional Sales Representative.

In his new post, Mr. Baker's sales representation will extend over the territories of the Company's Chicago, Detroit and Minneapolis operation, but he will continue to make his headquarters in Chicago. He has been Manager of the Chicago District Office since 1934.

The Company also announced the appointment of Mr. C. C. Bray as Manager of the Chicago District Office. Mr. Bray will assume charge of all sales activities of the Company in this territory. He was formerly Manager of the Midwest District Office.

Stainless Steel Water Baths

1108

Labline, Inc., Chicago, Illinois, is offering a new complete line of utility and serological Water Baths with exclusive features.

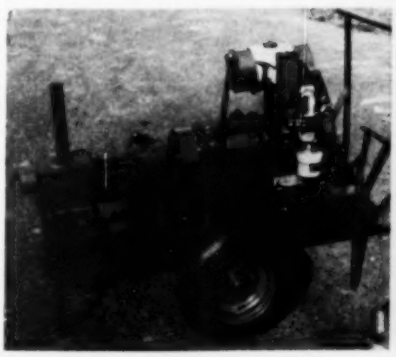
Among the exclusive features are: polished 18-8 stainless steel interiors

FORD ACCURACY
Replaces "Old Timer" Testing Methods

FREE
New Ford catalog that describes our valuable meter testing equipment.

The old-timer who tested his meters by blowing them, has been outdated by modern Ford Meter Testing Equipment. Whether you test your meters one at a time or in batteries of ten or more, Ford provides exceptional accuracy, fast changing and easy visibility. You get utmost economy regardless of the size of your shop. Send for full information.

THE FORD METER BOX COMPANY, INC.
FOR BETTER WATER SERVICES
FORD
Wabash, Indiana



GATE OPERATORS
—
PORTABLE
—
FOR STANDS & UNDERGROUND GATES—MOTOR TRUCK MOUNTED
PAYNE DEAN & CO.
CLINTON, CONN.

and exteriors; streamlined trim appearance; special thermostat gives complete range from room to 100° C.; sensitivity and uniformity better than ½° at any point to 100° C.

A special feature is a heat diffuser plate which eliminates "Hot Spots" . . . and assures even temperatures. The baths have efficient 1 inch insulation and large water capacity.

Executive Changes at Fairbanks-Morse

Fairbanks, Morse & Co., Chicago, Ill., has announced the following recent changes in personnel:

W. E. Watson, who has for several years been Manager of the Pump Manufacturing Division of the company, has been promoted to Assistant to the Manager of Manufacturing, with headquarters in Chicago.

Paul R. Flood who, since 1950, has been Manager of Manufacturing of the company's Beloit, Wis., Works, has been transferred to Pomona, Calif., where he has been appointed General Manager of the company's Pomona Pump Works succeeding Charles L. Barrett who has become a consultant to the Pump Division.

Lewis H. Kessler has been named Chief Hydraulic Engineer at the company's Beloit Works. He succeeds R. C. Glazebrook who, since March of last year, has been on special assignment to the General Manager with duties relating to the new Fairbanks-Morse plant now under construction in Kansas City, Missouri.

"O" Ring Seal Throttle Valve

1109

Daniel Orifice Fitting Co., Los Angeles, Calif., has announced a new "Throttleseal" valve.

According to the company, the new valve is radically new in design and operation and incorporates and correctly adapts the use of "O" rings for positive "bubble-tight" shut-off. The valve comes equipped with the Throttle Plug-Spindle feature and micro-adjusting Rising Stem whereby the ratio of volumetric flow can be controlled from fully opened to less than one per cent of effective flow area through port.

The new "Throttleseal" valve is available in ¼ and ½ inch sizes, Globe or Angle type.

Two New Managers Named by Diamond Alkali

Diamond Alkali Company, Cleveland, Ohio, has announced the appointments of Earl J. Mills, as manager of the Chicago branch sales office, and John W. Kennady, as manager of the Southwest District sales office, which has its headquarters at Houston, Texas.

(Continued on page 107A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

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Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(Continued from page 106A)

The Chicago office supervises Diamond sales activities in a nine-state area comprising Illinois, Indiana, Iowa, Michigan, Minnesota, Wisconsin, Nebraska, and the Dakotas. The Southwest District embraces the states of Texas, Oklahoma, and Kansas.

Robert H. Morris

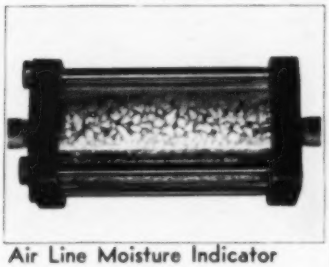
Mueller Co. Promotes 3 in Sales Division

Mueller Co., Decatur, Ill., has announced the following promotions in its Sales Division:

Robert H. Morris, formerly Sales Manager has been named General Sales Vice President. He joined Mueller Co. in 1947 as a sales representative traveling in Florida and Georgia. He was transferred to the Decatur office in June 1951. Morris graduated from the University of Illinois in 1941, and is a veteran of World War II.

Robert K. Levey, formerly Promotional Sales Engineer, has been appointed general sales assistant vice president. He joined Mueller Co. in 1929 as a salesman. In 1945, he was transferred to Decatur as Assistant Sales Manager.

Robert P. Jett, has been promoted from Mueller Co. salesman in the Los Angeles area, to Director of Sales Planning. He is a graduate of the University of California at Los Angeles.



Air Line Moisture Indicator

1110

King Engineering Corporation, Ann Arbor, Mich., has announced an Air Line Moisture Indicator for use in air or gas lines to give a positive visual indication of the presence or absence of moisture in the lines.

SMITH VALVES

WITH "O" RING SEAL

"O" Rings replace conventional packing and reduce maintenance to a minimum. The lower "O" Ring is the pressure seal, the upper "O" Ring the dirt seal. The specially compounded rubber plastic "O" Rings do not deteriorate and insure a long life pressure seal.

All Smith Valves can be equipped with "O" Ring Seal Plates. Write for details.

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

The unit consists of a pyrex glass cylinder filled with moisture-sensitive blue granules, and has end plates tapped for ¼ inch pipe. In operation, it is placed in the line between the air supply and the point at which the air is used. The granules stay blue as long as the air leaving the Indicator is dry, and turn pink when it contains moisture or water vapor.

Four tie rods protect the cylinder against damage and permit disassembly for recharging with dry granules. All units with glass cyinder are factory tested at 100 psi. Over-all dimensions are 5 inches long x 2 5/16 inches square. Pressure drop is less than 1 inch of water at a flow of 5 cubic feet per minute.

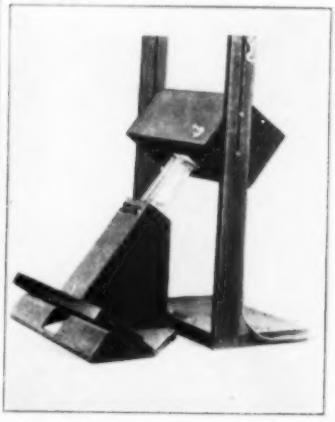
Manheim Joins Dearborn Chemical Staff

Dearborn Chemical Company, Chicago, Ill., has announced the addition of Mr. Theodore B. Manheim to its sales staff. He will take over the Philadelphia and Delaware territory, and will make his headquarters in Philadelphia.

Mr. Manheim came to Dearborn from Scholler Brothers, Inc., of Philadelphia, where he spent several years doing technical research development in textile chemicals. He received his B. S. degree in chemistry from Temple University, and attended the Philadelphia Textile Institute, where he was an instructor in research.

Ives Awarded 35-Year Service Pin by Armco

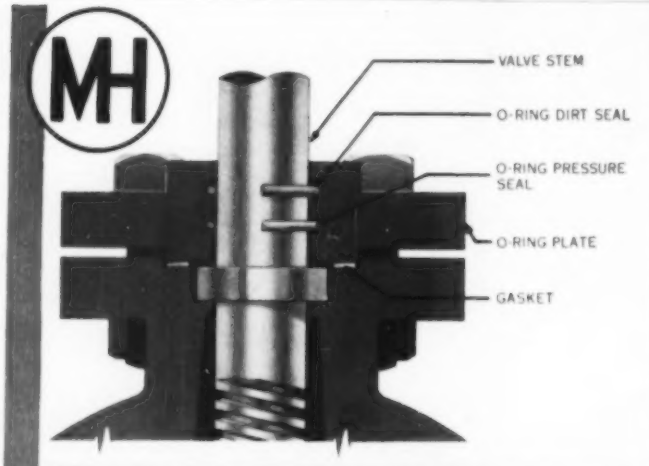
The above photograph shows Stuart R. Ives, President of Armco Drainage & Metal Products, Inc., a subsidiary of Armco Steel Corporation, receiving his 35 year Armco service pin from Charles R. Hook, Armco board chairman. Ives joined Armco in 1917 as an apprentice in the Annealing Department and has moved up through the ranks to his present position. He has been president of Armco Drainage & Metal Products, Inc., since 1947.



New Lamp Accessory for Water Analyzer

W. A. Taylor, Baltimore, Md., has announced the availability of a new lamp accessory for the Taylor Water Analyzer.

The new lamp gives uniform daylight conditions, thus is ideally suited for use when water analyses must be made at night or in poorly lighted



Rubber O-RING Seal for M&H VALVES

M & H Gate Valves can be furnished if desired with rubber O-Ring Seals at top of the stem, as illustrated. This type seal replaces the conventional packing, stuffing box, and gland-follower design. The Seal Plate contains two O-Rings, one of which is the pressure seal while the other acts as a dirt seal.

The O-Ring Seal is tight and leakproof and requires little or no maintenance. Both the rings are made of a specially compounded rubber plastic which does not deteriorate. However, if it should become necessary, replacement of the O-Rings is a simple and easy operation. For complete information, write or wire M & H VALVE AND FITTINGS COMPANY, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

areas. Measuring 15¾ x 9¼ x 7⅞ inches, it is fitted with a special daylite glass filter and bulb, and operates on any type of 110 volt current.

One special feature is that the lamp is fully adjustable so as to be adaptable for use with either long or short water analyzer tubes.

Scott Appointed Vice Pres. of Clay Products Assn.

National Clay Pipe Association, Cleveland, Ohio, has announced that Robert G. Scott, who for 16 years has served as chief engineer of the Association, has been appointed Vice President and General Manager.

Mr. Scott joined the Clay Products Association in 1936 following a 14-year professional career as a municipal consulting engineer. He is a graduate on Civil Engineering from Kansas State College, is a registered professional engineer in several states and has a Certificate of Qualification to practice engineering from the National Bureau of Engineering Registration.

A. J. Gates

Pipe Linings, Inc. Appoints Southwestern Representative

Pipe Linings, Inc., Los Angeles, Calif., has announced the appointment of A. J. Gates as southwestern representative for the company.

Mr. Gates, whose headquarters will be maintained at Ruidoso, New Mexico, brings to Pipe Linings 25 years of experience in water supply and distribution work, both ground and surface. He formerly was assistant city engineer of Wichita Falls, Texas; superintendent and engineer for the Wichita Falls water department; business manager for Midland, Texas, and also was con-

CONVERT A COST INTO A PROFIT

A Royer Model NSB-2 in operation at the City of Lenoir, N.C.

The cost item for disposing of sewage sludge can be converted into a profit by the simple method of processing the sludge . . . with a Royer Sludge Disintegrator . . . and selling it. Sewage sludge is a valuable fertilizer . . . in great demand by florists and nurserymen, golf clubs and parks, gardeners, mushroom growers and others. With a Royer all that is necessary is to shovel the cake right from the sludge beds into the hopper and the machine does the rest. A completely shredded, pulverized, aerated, ready-to-use fertilizer is discharged, free of twigs, stones and trash.

Sewage disposal plants throughout the United States are profiting with this money-making equipment. Write for a free copy of the "Sewage Sludge Datalog". It contains much information of interest to sewage plant operators.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

BELL JOINT LEAK CLAMPS

GASKET SEALER COMPOUND

CHARCOAL CAST IRON BOLTS

Also Anchored Glands for mechanical joints to replace socket clamps.

Write for information

H. Y. CARSON COMPANY

1221 Pinson St. Birmingham, Ala.

TG

TENNESSEE CORPORATION

SODIUM FLUOSILICATE

(Silico Fluoride)

Inquiries Invited

TENNESSEE CORPORATION

1028 Connecticut Ave., Wash. 6, D.C.

nected with Joe E. Ward, Wichita Falls consulting engineer.

Automatic Throwover Panel

1112

General Electric Company, Schenectady, N.Y., has announced a new automatic throwover panel, a control device that transfers electric circuits to an emergency power source when the normal source fails.

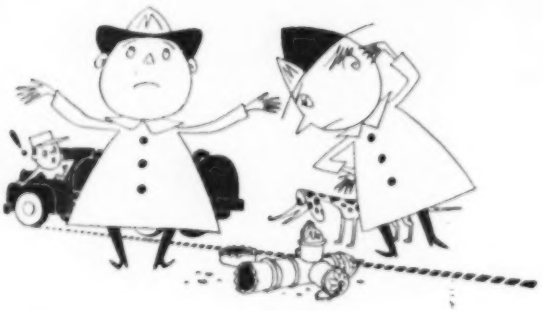
The new panel automatically transfers emergency lighting circuits, operating circuits, etc., to a standby power source when the regular supply is interrupted. It consists of mechanically interlocked, normal-source and emergency-source contactors, and a pilot contactor. Besides transferring circuits from a failed normal source to an emergency source and back again upon resumption of regular service, these contactors also control standby power equipment, such as an auxiliary generator, turning it on and off at the appropriate times.

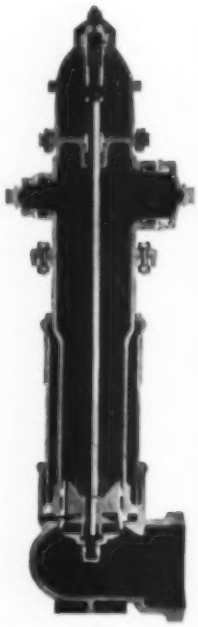
New Appointments at Hays Corporation

The Hays Corporation, Michigan City, Indiana, has announced the appointment of Phil Sprague, Jr., as Executive Vice-President of the company. Mr. Sprague, a Beloit College and Harvard Business School graduate, has been advertising manager for the past several years.

The company also announced the appointment of Paul B. LeBoeuf to succeed Mr. Sprague as advertising manager. Mr. LeBoeuf comes to Hays from the A. O. Smith Corporation, Water Heater Division, where he was in charge of advertising and sales promotion.

Broken hydrant cannot leak!





The main valve opens against water pressure and closes with it. This is foolproof protection against flooding when hydrants are broken in traffic accidents.

MATHEWS
HYDRANTS

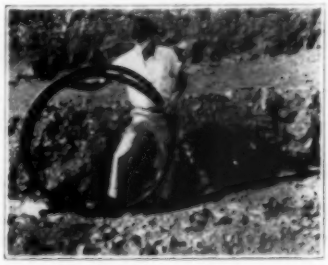
Made by R. D. Wood Company Public Ledger Building, Independence Square, Philadelphia 5, Pa. Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves.

Mathews Modernized Hydrants . . . Tops in Convenience and Dependability Compression-type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in barrel • A modern barrel makes an old Mathews good as new • Available with mechanical joint pipe connections

Ziegler Named District Manager for Sterling Electric

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced the appointment of Mr. Herbert F. Ziegler, Jr., as manager of the Kansas City, Missouri District Office of the company.

Mr. Ziegler is a native of Kansas City and is a graduate of Notre Dame University. After service in World War II as Lieutenant j.g., in the Navy, he took post-graduate work at the University of Friborg in Switzerland. Since that time he has gained wide and varied experience in industrial sales and is prepared to handle the motor application service needs of the area.



New Firm Enters Plastic Pipe Field

1113

Triangle Conduit & Cable Co., Inc., New Brunswick, N.J., has announced the production of two types of plastic pipe: Flexible and Semi-Rigid.

The flexible plastic pipe will be made of three types: Non-Toxic, industrial and suction. All three are

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

SAVE HOURS,

CUT COSTS ON YOUR

PIPING JOBS

PUSH PIPE UNDER STREETS, TRACKS, walks, floors and other obstacles with a GREENLEE Hydraulic Pipe Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes—model shown above for pushing ¾ to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump also available for extra case and speed of operation.

GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 225 Columbia Avenue, Rockford, Illinois, U.S.A.

made of Polyethylene. The non-toxic type is made in sizes ½ to 6 inches and all sizes up to 3 inches are available in coiled form. The suction type, available in sizes 2 through 6 inches, is designed for higher pressures in the larger sizes.

Triangle Semi-Rigid plastic pipe is made of Butyrate. It is available in ½ through 6 inches in twenty foot lengths with one coupling cemented. This type is flexible enough to follow ditching contours, yet its impact strength eliminates special care in back filling.

Cooper-Bessemer Expands Tulsa Office

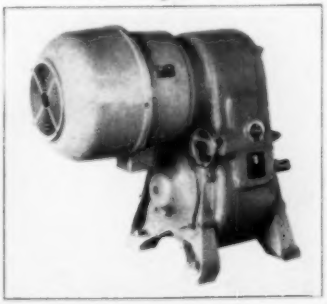
Cooper-Bessemer Corporation, Mount Vernon, Ohio, has announced the assignment of Robert E. Hensley to the company's Tulsa office.

An engineering graduate of Oklahoma A. & M., Mr. Hensley received his specialized training in engine and compressor operation at Cooper-Bessemer's headquarters plant. During World War II he was in pilot training for the Army Air Corps.

Hooker Opens Sales Office in Chicago

Hooker Electrochemical Co., Niagara Falls, N. Y., has announced the opening of a new sales office at 1 North La Salle St., Chicago, Ill.

Charles Y. Cain, Hooker's sales representative in the Chicago area since 1945, has been named district sales manager, and Donald McKechnie, who has been in the company's main offices for several years, will be Chicago office manager.



Totally Enclosed Fan-Cooled Sterling Speed-Trols

1114

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced that Speed-Trols, Variable Speed Electric Power Drives, in the range of 20 to 25 H.P. with 2-1, 3-1, 4-1 speed variation are now available in totally enclosed fan-cooled models.

The practical, economical answer to your underdrain problems

LEOPOLD

Glazed Tile

FILTER BOTTOMS

Successfully serving over 200 PLANTS with a daily capacity of over THREE-QUARTER BILLION GALLONS!

The Leopold Duplex Filter Bottom is made up of individual blocks, each weighing about 100 pounds, which are firmly joined together to provide a strong bed that is not disturbed by wash water. With this efficient, enduring system, you're assured an equal collection of filtered water with extremely low loss of head. There is no possible corrosion or tuberculation anywhere in the filter bottom.

Made of deaired fire clay—vitrified and salt glazed, the highly efficient Leopold Filter Bottom requires only shallow depth of small sized filter gravel and is acid and alkali resistant. Adaptable to any rectangular filter unit, it won't absorb any detrimental amount of water—and it's permanent.

Complete Water Purification and Sewage Plant Equipment . . .

- DRY CHEMICAL FEEDERS
- FILTER OPERATING TABLES
- MIXING EQUIPMENT

Write for details

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

Features of the new model include; dual cooling system for highly efficient internal and external cooling, air inside the motor is continuously circulated by the large diameter internal cooling fan through unobstructed air passages between the motor housing and stator, over the motor windings, and through openings in the rotor, thereby keeping the circulating air in continuous contact with the motor housing.

Executive Appointments at Allis-Chalmers

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced the appointment of J. D. Greensward as Vice President, general machinery division.

Greensward was recently named director of manufacturing for the division at which time he succeeded Fred Mackey who resigned as Vice President in Charge of Manufacturing. Previously Greensward was general manager of the Allis-Chalmers Norwood, Ohio, works.

At the same time P. F. Bauer was named general manager of the Norwood Works and manager of the firm's apparatus department succeeding Greensward.

The new vice president has been employed by Allis-Chalmers since 1922. He joined the company immediately after graduation from the Marquette University Engineering School.

Schaible Company Appoints Nugent Vice President

The Schaible Company, Cincinnati, Ohio, has announced the appointment of Frank J. Nugent as Vice President in charge of sales.

Mr. Nugent has filled top sales executive posts with Rheem Manufacturing Company, Bryant Heater Division of Affiliated Gas Equipment, Inc., and recently resigned as Sales Manager of the Ingersoll Division, Borg Warner Corp., to accept his new assignment. He will take charge of all sales, promotional and public relations activities for the Schaible Company.

Circular Collectors

Types for every waste treatment problem

- DESIGNED FOR EFFICIENT LONG-TERM OPERATION
- ENGINEERED FOR USE IN CIRCULAR OR SQUARE TANKS
- SELECTION OF DRIVES TO MEET YOUR SPECIFICATIONS
- CLARIFLOW THICKENERS FOR FLUE DUST CLARIFICATION

TRACTOR DRIVE COLLECTOR

This pier-supported collector is designed for circular tanks. The rotating bridge acts as the lever arm rotating a sturdy center cage which carries the collector arms. Rotational force is provided by a two-wheeled, rubber tired tractor unit running on the rim (or effluent weir wall of the tank). Drive unit is simple, easily accessible, and not affected by snow or ice.

SUSPENDED COLLECTORS are used where a simple bridge can span the tank diameter. In this case, the complete motor and drive assembly, together with the drive tube and collector arms, are suspended from the bridge.

WRITE FOR BULLETIN 9W65

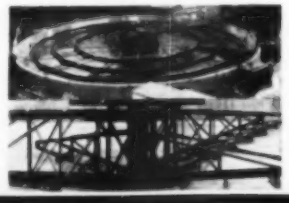
CLARIFLOW THICKENER

This unit utilizes the principles of fluid mechanics, so highly developed in Walker sedimentation units. It removes all settleable solids and remarkably clarifies the flow. All parts are sturdily built . . . designed for the "tough" jobs.

WRITE FOR BULLETIN 10160

PIER DRIVE COLLECTOR

The Pier Drive Collector is recommended where it is undesirable to operate a Tractor Drive . . . where the access bridge must be stationary, or the corners of square tanks must be scraped. Center drive mechanisms, ranging from 1/2 to 10 horsepower, are built for long life and heavy duty service. Worms are carburized and ground steel and precision meshed with hardened bronze worm wheels. The balls run in hardened, ground, renewable ball races.



PROQUIP PROCESS EQUIPMENT

WALKER PROCESS EQUIPMENT INC.

FACTORY • ENGINEERING OFFICES • LABORATORIES

AURORA, ILLINOIS

Ratchet-Lever Hoist

1115

Coffing Hoist Company, Danville, Ill., has the new Model R coil-chain ratchet-lever hoist now in production.

The Model R retains the ratchet and pawl operating principle originated by Coffing and used in previous models. This type of construction, it is claimed, eliminates the necessity of a friction brake. The load is suspended on the ratchet and pawl at all times, thus cannot slip, nor will the holding mechanism freeze.

Use of coil instead of roller chain is said to permit the chain to swing or wrap easily in any direction. When not under load, it may be pulled freely through the hoist head for quick adjustment. The handle operates in any position, which solves

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

the problem of working in cramped quarters or where there is little head room. Also, the handle can be operated with either partial or full strokes. Safety stops prevent spinning of the handle.

Elsener Elected Vice Pres. of Chicago Bridge & Iron

Chicago Bridge & Iron Company, Chicago, Ill., has announced the election of L. A. Elsener, manager of the company's San Francisco office, as Vice President.

Mr. Elsener was born in Alexandria, Indiana and graduated with a B.S. Degree in Civil Engineering from Purdue University in 1922. He has been associated with the Chicago Bridge & Iron Company since his graduation, and was a contracting engineer in the San Francisco office from September, 1923 to July 1928, and has been Manager of that office since that time.

Proportioneers Trailer Starts Nation-Wide Cruise

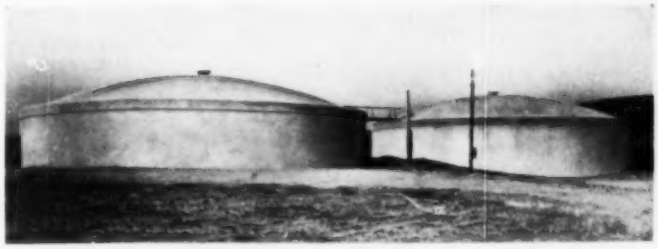
Proportioneers, Inc., Providence, R.I., is touring the United States with a new 40-ft. motor trailer in which are installed working exhibits of Proportioneers products.

A factory demonstrator, who will operate the exhibits and describe their many applications, will be in charge of the "Yankee Clipper." Twenty tons of equipment from the smallest Proportioneers unit for chlorinating domestic water supplies to large proportioning pumps for industry are installed in the trailer and can be demonstrated.

Units displayed include equipment for the fluoridation of water supplies, hypochlorination of water and most other processes applicable to the water treatment field.

Alloy Steel Appoints Evans District Manager

Alloy Steel Products Company, Inc., Linden, N.J., has announced the appointment of Herbert V. Evans, Jr., as District Manager of the Wilmington, Delaware office.



PRE-STRESSED "GUNITE" TANKS

Above are shown two 80' diameter 750,000 gallon prestressed "GUNITE" water storage tanks with "GUNITE" dome roofs. We built these tanks in 1943 for the Borough of Schuylkill Haven, Penna.

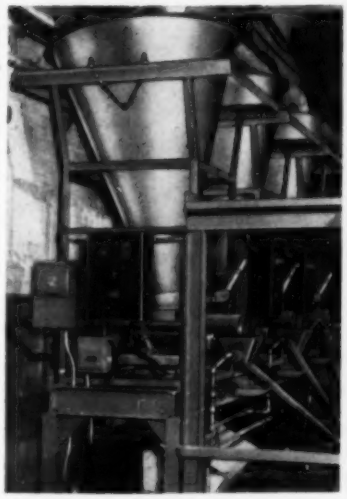
Prestressed "GUNITE" produces a water storage tank which is bottle tight and maintenance free. They may be built either at ground level, completely underground with earth covering over the dome roof, or may be in the form of stand-pipes or elevated tanks.

Our experience in this field includes scores of tanks and silos of many types ranging up to two and one-half million gallons capacity.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin C2400. We will gladly send a copy at your request. On your letterhead, please.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

For Feeding Dry Chemical Reagents—



3 Open Model FM-1-80 Feeder Machines feeding in a water treatment system. (Also available in Cabinet style Models for different sized treatment systems.)

SYNTRON
"Vibra-Flow"
DRY FEEDER MACHINES

Each machine is a complete unit, having a supply hopper equipped with a Syntron electromagnetic Vibrator to assure a free flow of chemical to the Syntron "Vibra-Flow" Vibratory Feeder which in turn controls the flow of chemical into the system.

Minimum feed rates as low as 8 pounds per hour of most chemicals with standard control—lower feed rates per hour may be obtained with a special control.

Volume control of rate of chemical feed may be made by manually adjusting the rheostat in the machine's control panel—automatically by scale movement—or by impulses from pH and venturi devices.

Write Now for FREE Catalog Folder

SYNTRON COMPANY
650 Lexington Avenue — Homer City, Penna.

For the past five years Mr. Evans has been sales representative for the company at Pittsburgh, Pa. Prior to that time he was with the Lebanon Steel Foundry for three and a half years, and with Anti-Corrosive Metal Products for a year. He served with the U. S. Army during World War II and is a graduate of Boston College.

In his new capacity, Mr. Evans will concentrate on activities in the Wilmington area but will also have general supervision over the Pittsburgh territory. His headquarters will be at 226 West Ninth Street, Wilmington.

W. J. Kingsley Promoted by Carborundum Company

The Carborundum Company, Niagara Falls, N. Y., has announced the appointment of William J. Kingsley as assistant general sales manager.

Mr. F. J. Tone, Jr., vice president, stated that "Mr. Kingsley's appointment is purely an administrative change made in recognition of Carborundum's growing sales responsibilities. It is intended for more efficient administration of the Company's growing sales volume and diversification of product lines."

In his new position, Mr. Kingsley will assist the general sales manager in all general sales activities of the company. Carborundum has district sales offices in 12 principal cities throughout the country.

Portable pH Meter

1116

Photovolt Corporation, New York, N.Y., has announced a new low priced battery-operated pH meter.

The new meter uses only 3 ordinary radio batteries which give 2000 hours of service.

According to the company this has been achieved by the use of advanced designs of subminiature tubes and circuits which also made possible a reduction in the number of electronic components. Operation and maintenance are greatly simplified and yet the high accuracy of 0.03 pH is insured.

Although the meter is primarily intended for battery operation, a stabilized power supply unit can be furnished to operate the instrument from the AC power line without the use of batteries.

Leeds & Northrup Move Philadelphia Office

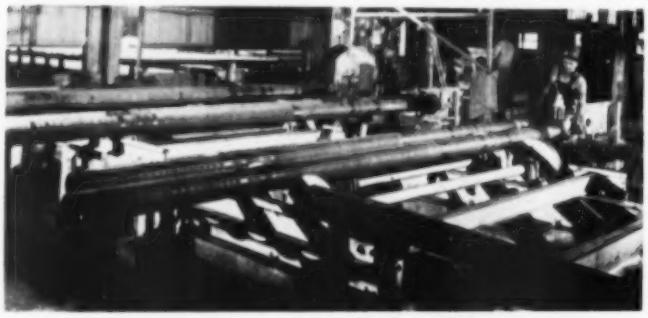
Leeds & Northrup Company, Philadelphia, Pa., has announced that the Philadelphia district sales office has moved from 4901 Stenton Avenue to new and larger quarters at 444 North 16th Street.

The company's advertising department and training school will occupy the remaining space at the new 5-story building. A large adjoining warehouse is also being occupied by the firm.

U.S. Stoneware Appoints Kiernan Sales Engineer

U. S. Stoneware Company, Akron, Ohio, has announced the appointment of Frank J. Kiernan as Sales Engineer.

Mr. Kiernan, who has made his headquarters in U. S. Stoneware's



Centrifugal cement-lining machine in operation at a McWane-Pacific pipe plant.

McWANE-PACIFIC
Cement-Lined CAST IRON PIPE
MAINTAINS FLOW

McWane-Pacific Super-DeLavaud Cast Iron Pipe and Pipe Fittings are furnished with either standard thickness of cement lining or thin cement lining with seal coat, when so specified. The cement lining is applied centrifugally in standard Super-DeLavaud cast iron pipe, either open bell-and-spigot, or Precalked Mechanical Joint.

For those sections of the country where soft water may cause interior tuberculation, cement lining protects the pipe from tuberculation and maintains a high coefficient of flow over a long period of time.

McWane-Pacific cement linings adhere strongly to the interior wall of the pipe. The pipe may be cut and tapped without damage to the cement lining. For complete information, write or telephone—

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PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

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Denver 2, Colo.	1921 Blake Street
Los Angeles 48, Cal.	6399 Wilshire Blvd.
San Francisco 4, Cal.	235 Montgomery St.
Portland 4, Oreg.	501 Portland Trust Bldg.
Salt Lake City	Waterworks Equip't Co.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

New York office, holds the degree of Bachelor of Science in Chemical Engineering which he received upon completion of a five year cooperative course at the University of Detroit.

Redmon Appointed Manager of Dallas Branch for A. O. Smith

A. O. Smith Corp., Milwaukee, Wis., has announced the appointment of John J. Redmon as manager of the company's Product Service branch at Dallas, Texas. He succeeds Ben Heald who is returning to full time sales activity for A. O. Smith.

Mr. Redmon, a native of Denison, Texas, was formerly associated with the Johnson Motor Lines of Denison.

J. W. Rushing has been appointed assistant manager. Mr. Rushing joined A. O. Smith in October, 1949 at the Dallas branch.

Literature & Catalogs

SlipSeal Sewer Joints

1117

Asphaltic Specialties Company, Plainfield, N.J., has available a folder entitled **"SlipSeal With the Modern Compound for All Precast Joint Systems."**

The folder describes the precast joint as a system that provides a Bituminous compound tapered collar that is cast by moulding, onto the spigot and inside the bell. Each step in the making of a precast joint is discussed, and illustrated, along with its advantages. A list of the physical properties of the compound and complete specifications complete the folder.

Walking Beam Flocculating Equipment

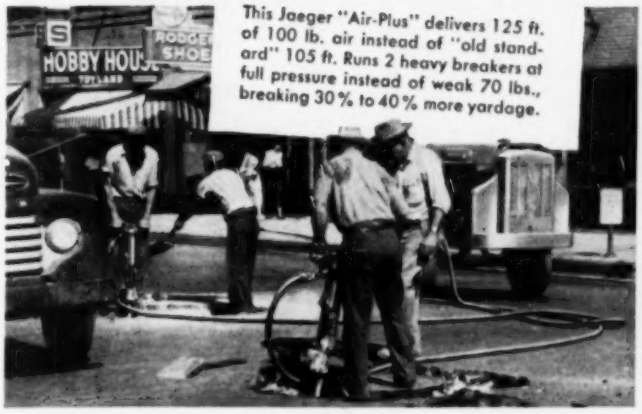
1118

Stuart Corporation, Baltimore, Md., has just published a new booklet on **Stuart's New Walking Beam Flocculating Equipment.**

The booklet is designed on a question and answer basis. The questions cover all points about the equipment and "cartoon" type illustrations emphasize each point.

The rear section of the booklet is devoted to photographs of actual installations and reproductions of letters from satisfied users of the equipment. Complete specifications are also included.

You Can Do 4 Days' Work in 3 with "New Standard" Jaeger Compressors



This Jaeger "Air-Plus" delivers 125 ft. of 100 lb. air instead of "old standard" 105 ft. Runs 2 heavy breakers at full pressure instead of weak 70 lbs., breaking 30% to 40% more yardage.

75 ft. 125 ft. 185 ft. 250 ft. 365 ft. 600 ft.

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See your Jaeger distributor or write for Catalog JC-1.

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W. S. Rockwell 54" heavy duty butterfly valve; for 50 p.s.i.; with geared handwheel operator. May be equipped for electric, pneumatic or air operator control.

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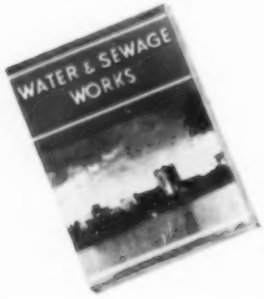

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Mixed Bed Demineralizer

1119

Permutit Company, New York, N.Y., has prepared a 4-page bulletin, entitled **"Mixed Bed Demineralizer."**

The bulletin describes a system consisting of a single ion exchange unit containing a homogeneous mixture of a cation exchanger and an anion exchanger. According to the bulletin, this arrangement provides a great number of individual demineralizing steps with the result that all scale-forming and other mineral impurities are reduced to the vanishing point—so low that they cannot be determined by conventional water analysis methods.

No-Ox-Id Versus Water

1120

Dearborn Chemical Company, Chicago, Ill., has available copies of **No-Ox-Id Versus Water,** the booklet that covers Dearborn Products for Water Works and Sewage Disposal Plants.

The booklet covers the application and uses of No-Ox-Id in all parts of the water works or sewage disposal plant, from settling tanks to valves. Fourteen full-page photographs show methods of applying No-Ox-Id and actual installations that demonstrate the condition of the equipment after years of use.

Squirrel-Cage Induction Motor

1121

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced a new bulletin on **Drip-Proof and Splash-Proof Squirrel-Cage Induction Motors.**

The bulletin relates that the drip-proof motors are available in all ratings in NEMA Design B, which is suitable for the majority of cage motor applications. Many ratings are available in NEMA Design C, for applications requiring high lock-rotor torque and normal breakdown torque.

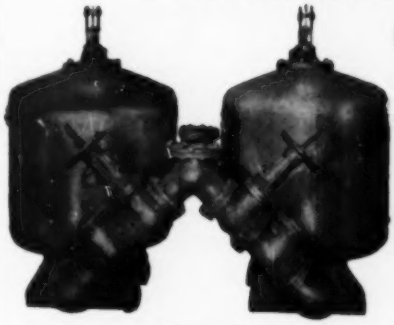
Water Works Equipment Catalogs

1122

Hungerford & Terry, Inc., Clayton, New Jersey, has available a series of 12 catalogs on water treating equipment and supplies.

These catalogs, attractively bound under one cover discuss: Inversand Zeolite Water Softeners; Pressure Type Water Filters; The Hungerford Gravity Air-Water-Wash Fil-

OVER 50 YEARS EXPERIENCE
—Yet as modern as tomorrow . . .



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Duplex Sewage Ejector, showing inlet piping.

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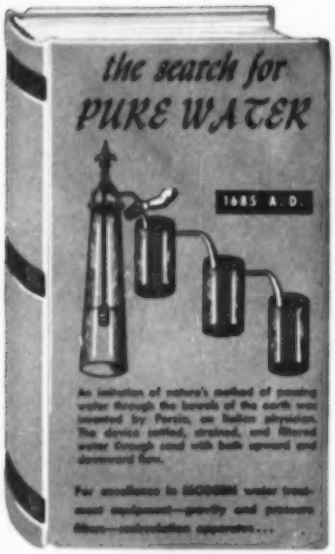

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Laboratory Instruments and Supplies

1123

Central Scientific Company, Chicago, Ill., has just released a new catalog on **Scientific Instruments and Laboratory Supplies for Clinical Testing Bacteriology and Biochemistry.**

This large 280-page catalog lists the complete line of equipment and supplies of the company. The first nine pages are devoted to a check list of laboratory equipment for the ordinary laboratory, unit prices are also given on the check list. Illustrations and descriptive text are shown on most of the equipment and supplies listed, and prices are shown for each item.

Protective Coatings

1124

Prufcoat Laboratories, Inc., Cambridge, Mass., has made available a new general catalog entitled **"Stop Profit-Eating Corrosion with Prufcoat."**

Subjects in the catalog include a list of chemical agents against which Prufcoat has been found effective, case history studies of five different types of applications in as many different industries, and a three point analysis of the advantages of maintenance painting done the Prufcoat way.

The entire back page of the catalog is devoted to a listing and brief

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No Caulking

description of the physical and protective qualities of all eight Prufcoat products. With this guide, it is a simple matter to determine the specific sealer, primer and finish material required for any painting problem.

Kennison Nozzle

1125

Builders-Providence, Inc., Providence, R.I., has issued a new technical bulletin on the **Kennison Nozzle.**

This bulletin provides pertinent engineering information including accuracy, construction, dimensions, installation and capacities of the Kennison Nozzle.

Also described are some of the uses of the nozzle for the measurement of the flow of liquids with and without the presence of suspended matter, and other applications.

The bulletin states that the nozzle is made in sizes from 6 to 36 inches, and can be used with standard totalizing, indicating and recording instruments.

Pumps for Abusive Applications

1126

Nagle Pumps, Chicago Heights, Ill., has available a 34-page catalog entitled **"Nagle Pumps."**

This attractive 34-page, 2-color catalog covers the complete line of pumps for water and sewage treatment plant applications. It describes in detail Automatic Priming Pumps; Single Stage Side Suction Pumps, both horizontal and vertical shaft types; Rear Entrance, Automatic Priming Pumps; Priming Inductors; Wet Pit Pumps; and Dry Pit Pumps.

Photographs and dimensional line drawings are included for each of the pumps discussed. Tables covering discharge size, dimensions in inches and approximate weights are also given.

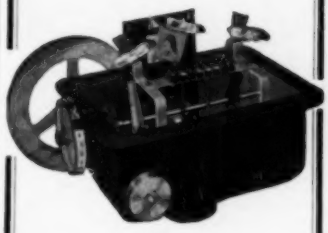
Complete Line of SK Flow Indicators

1127

Schutte and Koerting Co., Cornwells Heights, Pa., has just published a new bulletin on **SK Flow Indicators.**

This attractive 12-page, 2-color bulletin discusses flapper and rotary type sight glass flow indicators, with single and double sight glasses, and the SK Ball Flow Indicator. Photographs, dimensional drawings, dimension tables and performance curves charts complete the bulletin.

ROTO-TROL



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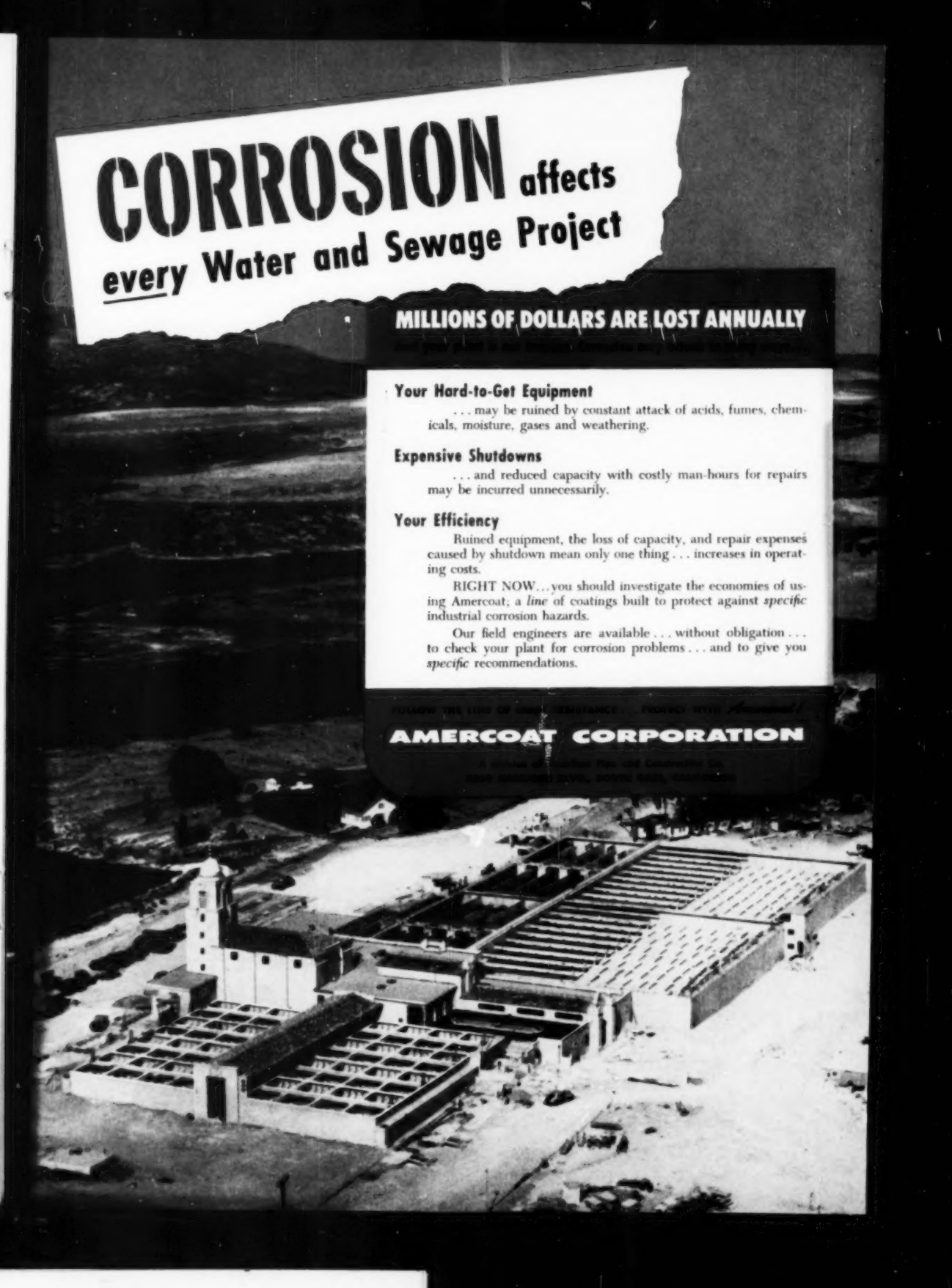
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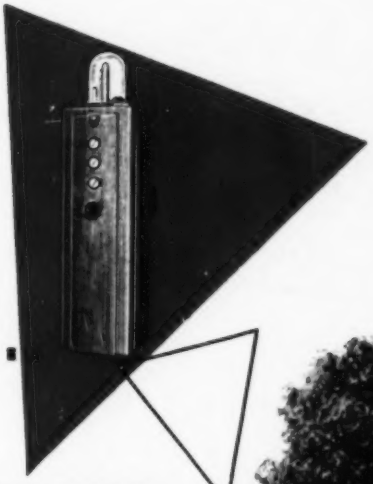

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